Texas Water Trends

Final Report:
Environmental Defense Fund

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Executive Summary

The Environmental Defense Fund (EDF) was created to find practical and lasting solutions to the most serious environmental problems. EDF understands that to achieve its mission, it must work to create a culture of inclusion and equity by actively seeking input and participation from all stakeholder communities, particularly those communities comprised of underserved or At-Risk populations. The goal of this project is to provide a baseline, holistic understanding of where diversity, equity and inclusion (DEI) and environmental justice (EJ) issues intersect with water issues and challenges within Texas. Below is a list of key findings and action items stemming from this research project organized by the report's three sections:

Texas Demographics

- In review of the state's demographics, Communities At-Risk are primarily found in urban areas. Additionally, South and Far West Texas are mostly Communities At-Risk. In contrast, most rural Texas demographics are predominantly white and older populations. Communities At-Risk in Texas are predominately Latino followed by African American.
- Action: Programming and engagement strategies of these Communities At-Risk should consider location, cultural relevancy, and the predominant communities being served. For the former (location), the nexus of data for Communities At-Risk and water challenges can serve to address water equity challenges and opportunities for meaningful community engagement.
- Population density, age, and race and ethnicity are expressed primarily at a regional scale (urban and rural), where urban areas are characterized by diverse, younger and higher density population groups, and rural areas are characterized by less diverse, older and lower density populations.
- In contrast, poverty, income, unemployment, labor, and education are expressed at a local scale, meaning zip codes or neighborhoods matter within a given area. In Bexar County, for example, these variables are expressed within a county locally compared to more regional differences. This is not surprising given drivers in vulnerability indices described in the report are framed by these factors, resulting in the demographic makeup of the state.
- Action: Communities At-Risk are locally distributed and not random within urban areas. Within rural areas, zones of Latino prevalence are small compared to land mass. Mapping of Communities At-Risk is helpful for EDF programming and engagement strategies that are targeted and purposeful.
- Action: Linguistic isolation can be an important barrier to water resources for Communities At-Risk, particularly for safety (flooding and drought). Preference for Spanish materials manifested as low in rural areas compared to other parts of the state. This may be associated with preferences in receiving information or that pockets of Latino community respondents were too small in rural areas to influence overall survey results. Some bilingual programming efforts may be beneficial, especially along border regions and urban areas.

- Rural landowners are primarily Non-Hispanic White, male and older, reflective of rural communities. Non-Hispanic White rural landowners control 87% of Texas' ecosystem service benefits.
- With some exceptions, policymaker structure is reflective of their county population with respect to race, age, and ethnicity, similar to rural and urban counties.
- Action: Because pockets of Communities At-Risk are in rural areas, they may not be well represented in policy-maker structure. EDF program and engagement strategies might include:
    - Strategic and meaningful, paid, long-term, targeted training, involving high contact hours, particularly for water leadership positions and for rural county leadership positions, as these involve complex systems, unique community cultures and specific processes and skills.
    - Caring, long-term mentorship and supportive personal networks within professional settings – assign several individuals that are a match for recruits to create a safe environment where there is freedom to ask questions, push boundaries and gain experience, to fall and learn without fear in a supportive work family, and to receive redirection and responsibilities with expectations for success, not a lowering of standards.
- Action: There was congruence between models of Communities At-Risk where each of the three approaches validated one another. A shortcoming of many of these modelling approaches is that they may not specifically include water challenges in a more comprehensive fashion, thus, integrating location of Communities At-Risk and explicit water challenges as was conducted in this study would aid EDF programming and engagement efforts. Further mapping at higher or more local resolutions may be beneficial in future efforts.

Water Characteristics

- Pressure and demand for water resources will only continue to increase in the coming years for the state in both urban and rural areas. It will be a significant social, economic and demographic issue, defined by specific parameters, such as water supply, water quality, flood risk, affordability and accessibility.
- The location of many water challenges is primarily found in and around urban centers. The nexus or overlap of water challenges and Communities At-Risk are identified in key areas across the state.
- Action: Development of a water equityscape map demonstrates the overlap with Communities At-Risk indices and water challenges. Data suggest that Communities At-Risk are exposed to these challenges in some cases at a disproportionate rate. EDF can use this approach to identify high-priority areas in programming and engagement efforts. Further mapping at higher or more local resolutions may be beneficial in future efforts.

Texas Water Survey

- Water concerns centered on availability, drought, quality, affordability, ground water and surface water. When it came to trust in drinking water quality, 78% of water users trusted their drinking water quality, while at least 89% of water providers, community leaders and water professionals trusted the quality of their drinking water.
- When considering water dependability, availability, quality, and high cost were respondent considerations, along with infrastructure damage outside of one's property. With respect to dependability and access, people felt they have dependable water sources and quality, yet there is a real concern that these may not be a reality in the future. Also, once safety has been breached, it might take some community members a long time to trust their water source again, thereby, increasing their cost of water.
- Drought and overall water availability weighed heavily on survey respondents' minds, yet they also felt current water dependability and affordability were generally good or satisfactory, with some slight dissatisfaction. The contradiction suggests future water may be more of the driver for the concern. Most communities and respondents had personal experiences with either flood and/or drought.
- Dependency on groundwater continues to grow, with 54% of water user respondents not owning a private well, 45% depending on water utility water, and 34% indicating private well use (5% inactive well ownership, 8% both active and inactive wells on their properties). All place great pressure on the state's water sources and pose significant challenges moving forward, which were validated by expressed respondent concerns (10% of well owning respondents indicated their wells had gone dry in the past 5 years). Regarding well water quality responsibility, well management, and the role of managers, there was a heavy emphasis on well owners, everyone above the aquifer recharge zone and groundwater conservation districts as having responsibility for wells.
- Respondents felt opportunities to recreate existed across the state, although policymakers, water providers, and water professionals felt water users had more time to recreate than was their reality.
- Action: Improving recreation access may be beneficial, by making it easier for people to recreate, but not without simultaneously addressing other barriers, such as time to recreate, accessible groups with whom to recreate, and decreasing distance to recreational areas or providing transportation options.
- There was a preference for staying within one's comfort zone with respect to communications. For example, water users preferred sharing information in-person (42%), via community meetings (31%), written media (29%), directly with the water provider (25%), water meetings (24%), local traditional media (22%) and phone messages (21%). They also preferred to receive water information via written media(41%), water providers (39%), local traditional communications (30%), groundwater conservation districts (29%), community meetings (26%), internet advertisings (24%) and community postings (23%),

water meetings (22%), and phone messages (15%). There were slight differences in information sharing and receiving among community leaders, water providers and water professionals.

- Action: To meet community needs, align incoming and outgoing communication strategies for accessibility, to reach water users more effectively, may be a consideration, especially when safety may be a consideration. There appears to be communication among water professionals, water providers, and water leaders; however, increasing and/or maintaining communication with water users would be helpful.
- Borderland communities appear to have the greatest distrust for drinking water quality of all groups surveyed.
- Action: Determine if water quality perceptions in the region are associated with structural and accessibility factors (testing, infrastructure, citizen participation, community wide efforts, including water providers, water professionals, and community service organizations as avenues for ameliorating water quality challenges).
- Action: Accessibility to well maintenance programs and/or information may be a consideration given responses for maintenance limitations associated with maintenance costs.
- Action: Community engagement models supported by both case studies (The Texas Freedom Colonies Project and the Texas A&M Colonias Program), each with a long history of successfully engaging and training community members and returning trained members to their respective communities and to other aspects of active, in-community service (are *one* with communities they serve).

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Introduction

Problem Statement

Environmental conservation has long been interwoven with dynamics of racial oppression and exclusion related to race, class, and gender. Texas has not escaped the effects of this history and dynamics; however, EDF recognizes it lacks an understanding of this history and ways racism and exclusionary practices continue to impact conservation efforts. Furthermore, EDF understands that to achieve true sustainable water management, it must work to create a culture of inclusion and equity by actively seeking input and participation from all stakeholder communities, particularly Communities At-Risk (see note for definition at end of Introduction) and other underserved communities who are often excluded. EDF's success depends upon the ability to recognize historic and present-day inequities while including, supporting, celebrating and learning from the diverse voices of Texas and the regions its natural resources support.

Goals and Objectives

The goal of this project is to provide a baseline, holistic understanding of where DEI and EJ issues intersect with water in Texas. EDF focus areas include advancing sustainable land and water management practices and ensuring healthy, clean water sources for people and the environment. This project will provide a baseline understanding of underlying equity and environmental justice issues that intersect with the EDF's work and identify communities that are potentially impacted by and experiencing water inequity and water injustice within the state (Figure 1). Specific project objectives, defined and to be implemented by 3 primary tasks, include (Task I) collect and curate demographic data within the project area, (Task II) collect water management information from underserved communities via surveys and interviews, and (Task III) synthesize collected information and offer key recommendations for the Network to increase community engagement.

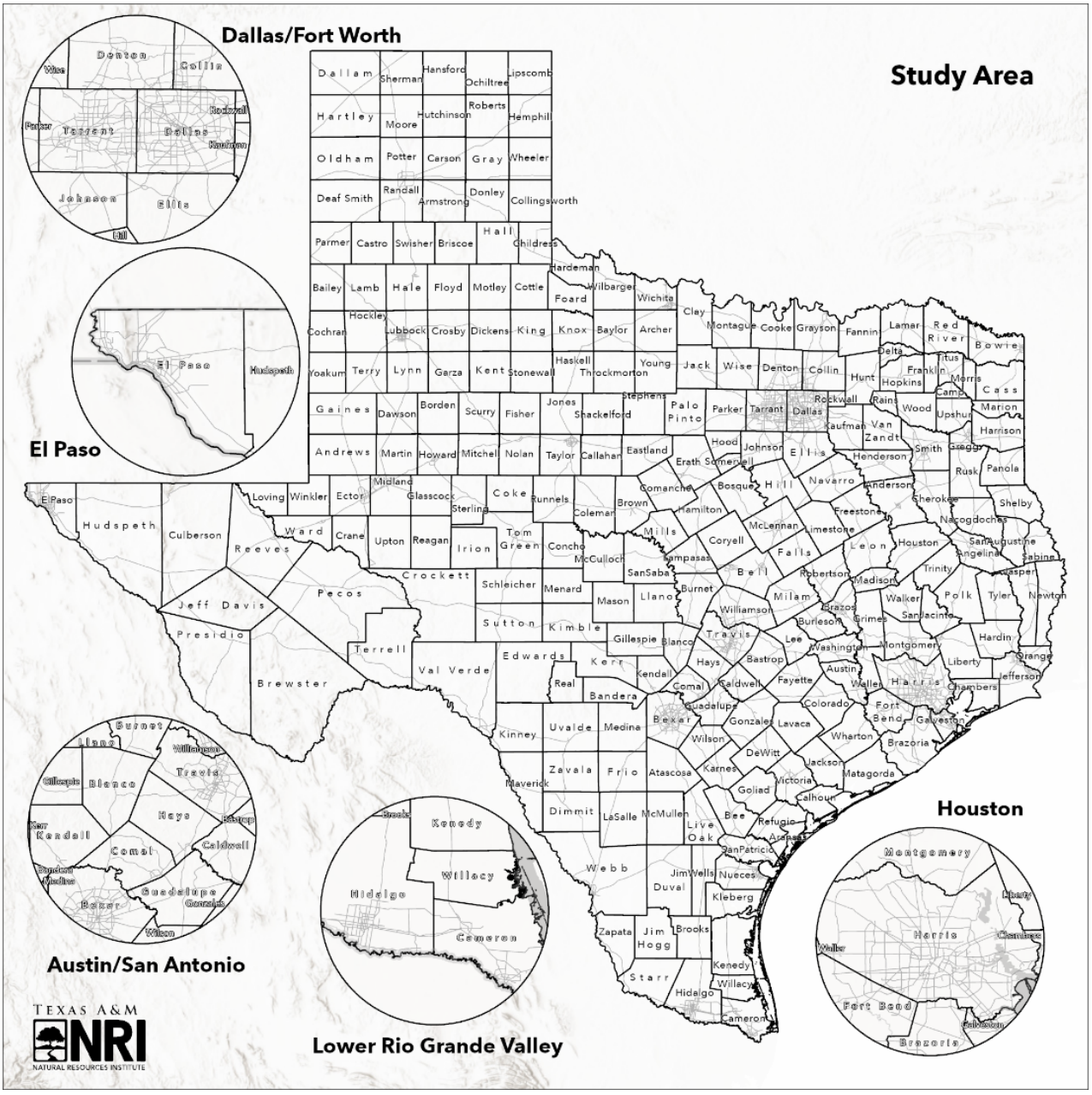


Figure 1. The 254 counties of Texas and 5 major populated areas, including Dallas/Fort Worth, El Paso, Austin/San Antonio, the Lower Rio Grande Valley, and Houston. Source: Texas Natural Resources Information System (TNRIS).

Note: Publicly available data was accessed for this report. This data is produced by different agencies whose terminology for various population groups differ. The term *Communities At-Risk* is used in this report as an all-encompassing term to describe the same populations covered by the datasets. By nature of the data, "low income" and "people of color" (both EPA definitions) encompass many Communities At-Risk. A list of some definitions of key terms by data source would be helpful to understanding descriptions in this report:

1. White or Non-Hispanic White: "Individuals who responded 'No, not Spanish/Hispanic/Latino' and who reported 'White' as their only entry in the race question (Census Bureau 2021)"
2. African American or Black: A person having origins in any of the Black racial groups of Africa (Census Bureau 2021).
3. Asian: A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam (Census Bureau 2021).
4. Hispanic or Latino: refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (Census Bureau 2021)
5. Indigenous Groups or Native Americans: A person having origins in any of the original peoples of North and South America (including Central America) and who maintains tribal affiliation or community attachment (Census Bureau 2021).
6. Low-Income: The EPA uses the term "low-income" to describe households whose household income is less than or equal to twice the federal "poverty level" (Source: EPA EJScreen).
7. Minority: In some reports by the EPA, the term "minority" is used to describe people of color (see definition above). The term Minority Communities is used to describe communities primarily made up of people of color, as described here.
8. People of Color: Individuals who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals. The word "alone" in this case indicates that the person is of a single race, not multiracial (Source: EPA EJScreen). Communities At-Risk, At-Risk Communities, and Communities of Color are defined and described in this context.
9. Poverty Threshold: The Census Bureau sets income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's poverty threshold, then that family is considered in poverty (Source: Census Bureau).
10. Distressed Communities, Susceptible Communities, and Socially Vulnerable Communities: These are additional terms used by various organizations to describe people of color and indices associated with people of color.

Note: Common data source acronyms used in this report include,

2022 State Water Plan, SWP
Center for Disease Control, CDC
Distressed Communities Index, DCI
Economic Innovation Group, EIG
Environmental Protection Agency, EPA
Environmental Protection Agency EJ SCREEN, EPA EJScreen
Groundwater Conservation Districts, GCD
Multi-Resolution Land Characteristics Consortium, MRLC
National Agricultural Statistics Service, NASS
National Land Cover Database, NLCD
National Oceanic and Atmospheric Administration, NOAA
Safe Drinking Water Information System, SDWIS
Social Vulnerability Index, SVI
Texas Commission on Environmental Quality, TCEQ
Texas Comptroller of Public Accounts, TCPA
Texas Department of Transportation, TXDOT
Texas Natural Resources Information system, TNRIS
Texas Water Development Board, TWDB
The Nichols Institute for Environmental Policy Solutions, NIEPS
United States Census Bureau, US Census
United States Department of Agriculture, USDA
United States Department of Agriculture Census of Agriculture, USDA COA

Section 1: Demographics in Texas

Overview

A deliverable for this project involved providing a demographic overview of Texas with an emphasis on people of color. This section provides a general, statewide demographic overview with regional highlights, general landowner and policymaker demographic information and locations of Communities At-Risk, a requested project deliverable (see note with definitions in Introduction). Our review provides an understanding of current statewide demographics of the state as it pertains to Communities At-Risk and water resources. The main source for demographic data draws from the US Census' American Community Survey. This survey counts people based on their *usual residence* and uses language from the Census Bureau and EPA.

Current Demographics

In this section, we see our history in action. Past collective decisions have shaped Texas' current demographic profile. A description of the state's population as a whole and specific race and ethnic characteristics, along with age are provided. Socioeconomic characteristics around the state of these communities are described, including poverty, income, unemployment, and educational attainment. Landowner and policymaker demographics are also described, along with Communities At-Risk within Texas.

Population Density

As of the 2019 American Community Survey (5-year average), there were 28,995,881 people living in Texas. A large majority of these people live in urban counties. The top five populated counties are Harris (Houston), Dallas (Dallas), Tarrant (Ft. Worth), Bexar (San Antonio), and Travis (Austin). These counties make up 44% of the state's population with over 12 million people. Texas has experienced rapid population growth in recent years. Between 2009 and 2019, the state grew by over 14%. Counties with the largest growth are located outside of Austin and San Antonio, along the I-35 corridor (Figure 2). Population loss was highest in Concho, Floyd, and Schleicher counties. In total, 77 counties lost population (Table 1).

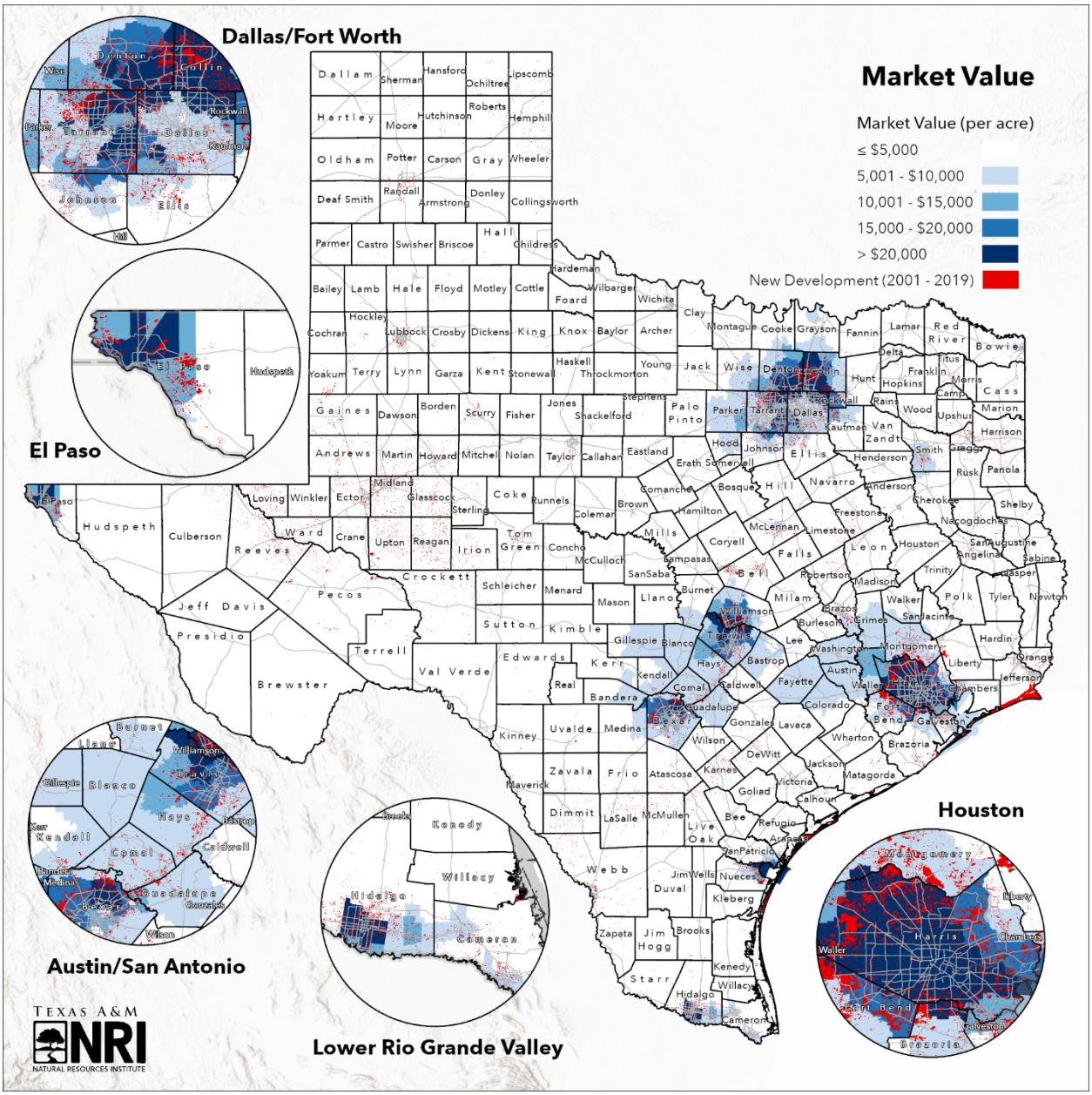


Figure 2. Urban development from 2001 - 2019 and rural land market values ($ per acre) in 2017 in Texas. Source: Multi-Resolution Land Characteristics (MRLC) Consortium National Land Cover Database (NLCD), Texas Comptroller of Public Accounts.

Table 1: County Population Change (2009 - 2019) in Texas.

County	7/1/2009	7/1/2019	Growth (%)
Statewide	24,801,761	28,995,881	14.46
Greatest Population			
Harris	4,034,866	4,698,655	14.13
Dallas	2,346,378	2,647,576	11.38
Tarrant	1,784,078	2,060,239	13.40
Bexar	1,685,628	1,997,417	15.61
Travis	1,006,503	1,273,554	20.97
Smallest Population (8 Counties under 1,000)			
Loving	77	96	19.79
King	279	274	-1.82
Kenedy	403	390	-3.33
Borden	618	680	9.12
McMullen	699	749	6.68
Most Growth			
Hays	153,619	228,364	32.73
Comal	106,350	156,317	31.97
Kendall	32,655	47,284	30.94
Williamson	410,800	589,216	30.28
Fort Bend	569,130	805,788	29.37
Most Decline (77 counties lost population)			
Concho	4,076	2,716	-50.07
Floyd	6,508	5,535	-17.58
Schleicher	3,311	2,822	-17.33
Terrell	930	794	-17.13
Sutton	4,272	3,664	-16.59

*Source: ACS 2019 (5-Year Estimates)

Age

As a whole, 45% of the population is 34 years or younger. At the extremes, 24% of the population is 18 and younger, and 18% is 65 and older. While this would suggest a population that has relatively well-balanced age groups, the distribution of old and young people varies across counties. Generally, rural counties appear to be older, while urban counties appear to be younger. For example, in Llano, 36% of the population is 65 years and older, compared to Travis County, where only 9% of the population is over 65 (Figure 3).

Race and Ethnicity

In total, Texas is less “White” and more “Hispanic or Latino”, when compared to the national average. Approximately 40% of people in Texas identify as “White Alone” and 39% identify as “Hispanic or Latino” compared to 60% and 18% at the national level (ACS 2019). Hispanic

populations are higher in the southern and western counties, especially counties along the Texas-Mexico border. The Rio Grande Valley has the highest Hispanic or Latino population density (Figures 4-5). Additionally, within more rural counties, cities have greater numbers of Hispanic or Latino populations than their rural outskirts.

Additionally, all race categories and Hispanic origin populations have increased statewide (Table 2).

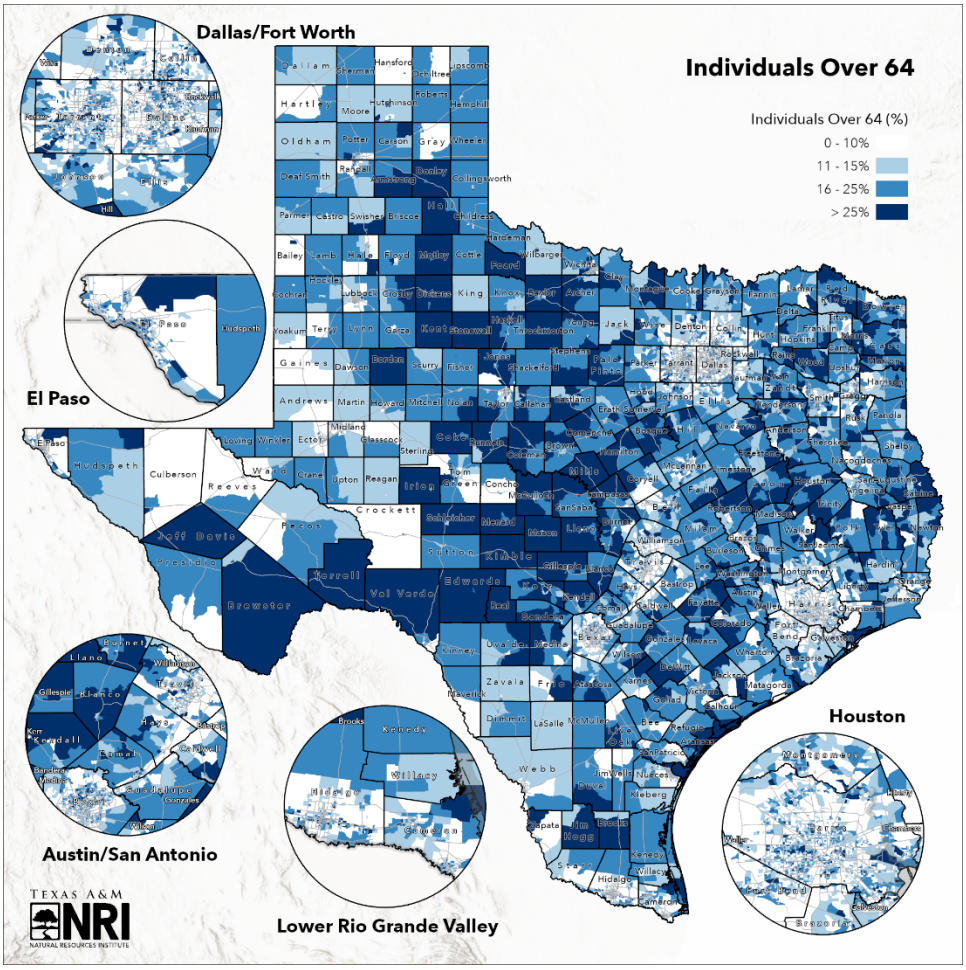


Figure 3. Percent population over 64 years of age by county in Texas. Source: U.S. Census Bureau.

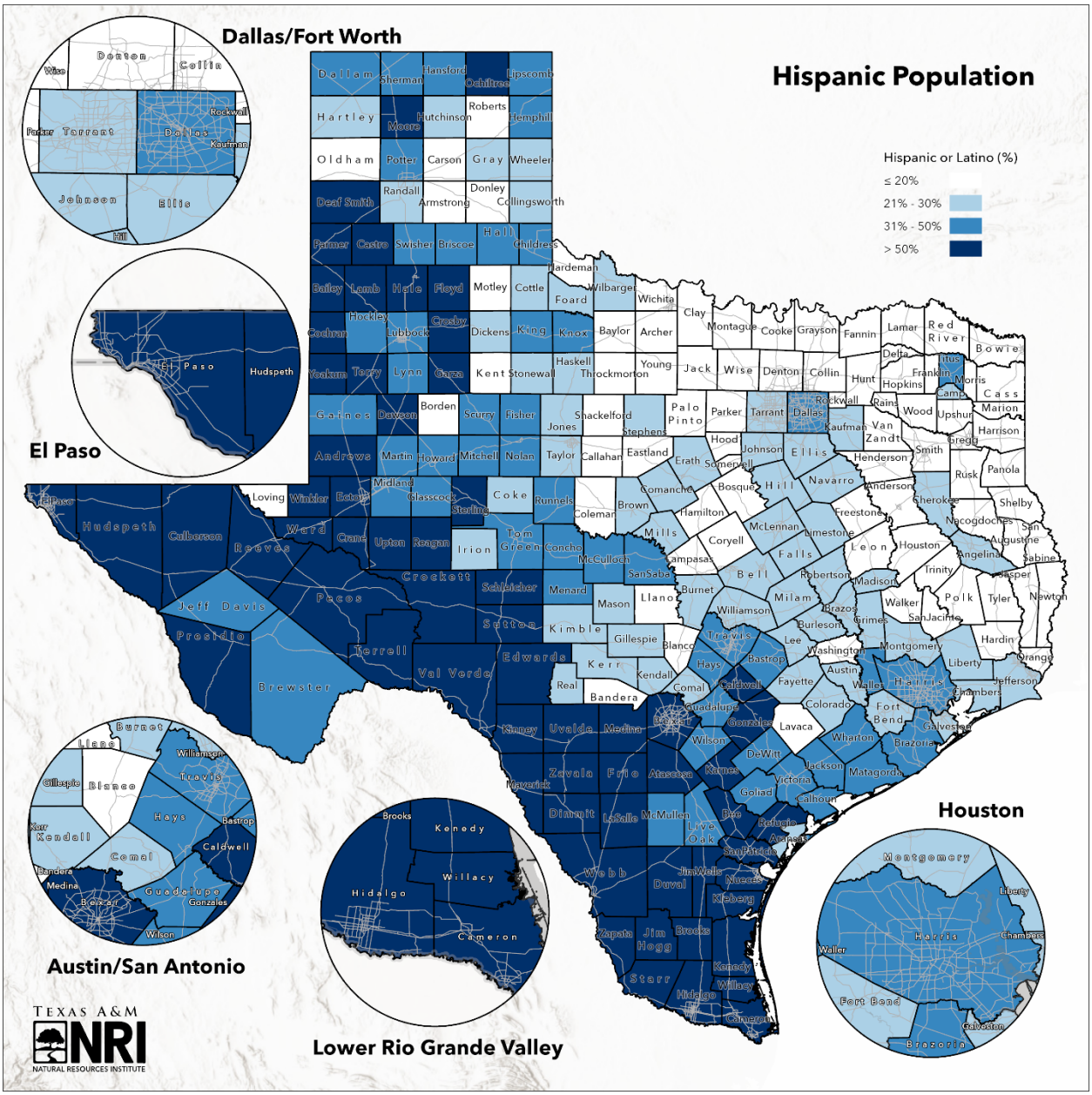


Figure 4. Percent Hispanic or Latino population by county in Texas. Source: U.S. Census Bureau.

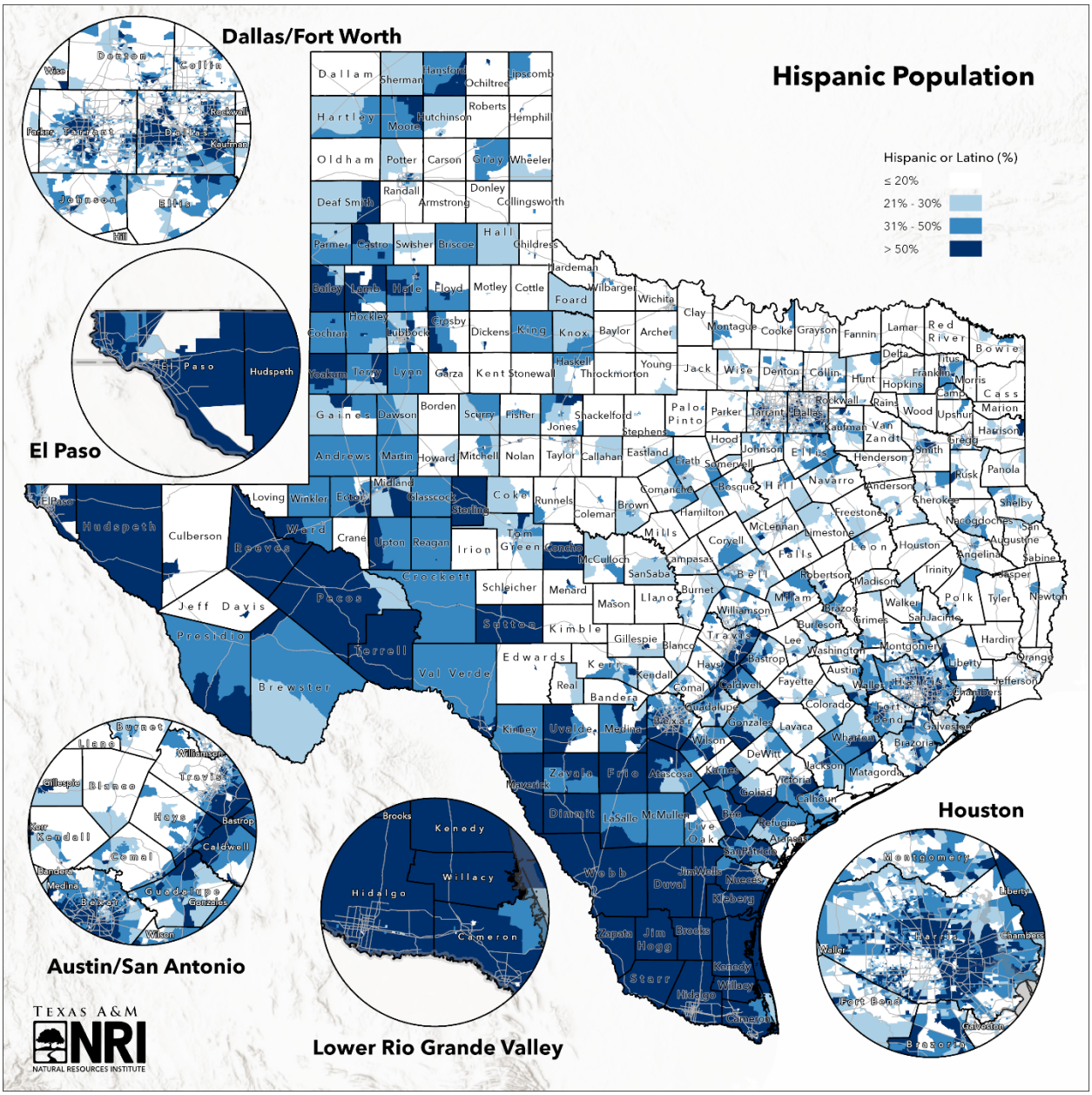


Figure 5. Percent Hispanic or Latino population by census block group in Texas. Source: U.S. Census Bureau.

Table 2. Percent race and Hispanic origin for Texas.

Race and Hispanic Origin	2009	2009 (%)	2019	2019 (%)	Change (%)
TOTAL POPULATION	24,801,761		28,995,881		14
One Race:	-	-	-	-	-
White	20,162,083	81.29	22,806,130	78.65	12
Black or African American	3,020,504	12.18	3,739,221	12.90	19
American Indian and Alaska Native	238,217	0.96	294,902	1.02	19
Asian	967,252	3.90	1,510,470	5.21	36
Native Hawaiian and Other Pacific Islander	30,395	0.12	43,212	0.15	30
Two or More Races	383,310	1.55	601,946	2.08	36
NOT HISPANIC	15,561,855	62.74	17,470,303	60.25	11
One Race:	-	-	-	-	-
White	11,391,513	45.93	11,950,774	41.22	5
Black or African American	2,858,593	11.53	3,501,610	12.08	18
American Indian and Alaska Native	80,572	0.32	94,168	0.32	14
Asian	929,211	3.75	1,457,549	5.03	36
Native Hawaiian and Other Pacific Islander	17,855	0.07	25,861	0.09	31
Two or More Races	284,111	1.15	440,341	1.52	35
HISPANIC	9,239,906	37.26	11,525,578	39.75	20
One Race:	-	-	-	-	-
White	8,770,570	35.36	10,855,356	37.44	19
Black or African American	161,911	0.65	237,611	0.82	32
American Indian and Alaska Native	157,645	0.64	200,734	0.69	21
Asian	38,041	0.15	52,921	0.18	28
Native Hawaiian and Other Pacific Islander	12,540	0.05	17,351	0.06	28
Two or More Races	99,199	0.40	161,605	0.56	39

*ACS 2019 (5-Year Estimates)

In Texas, 11.5% of people identify as “Black or African American Alone”. The majority of Black or African American populations are in Eastern counties, with high populations in Dallas and Houston. (Figure 6).

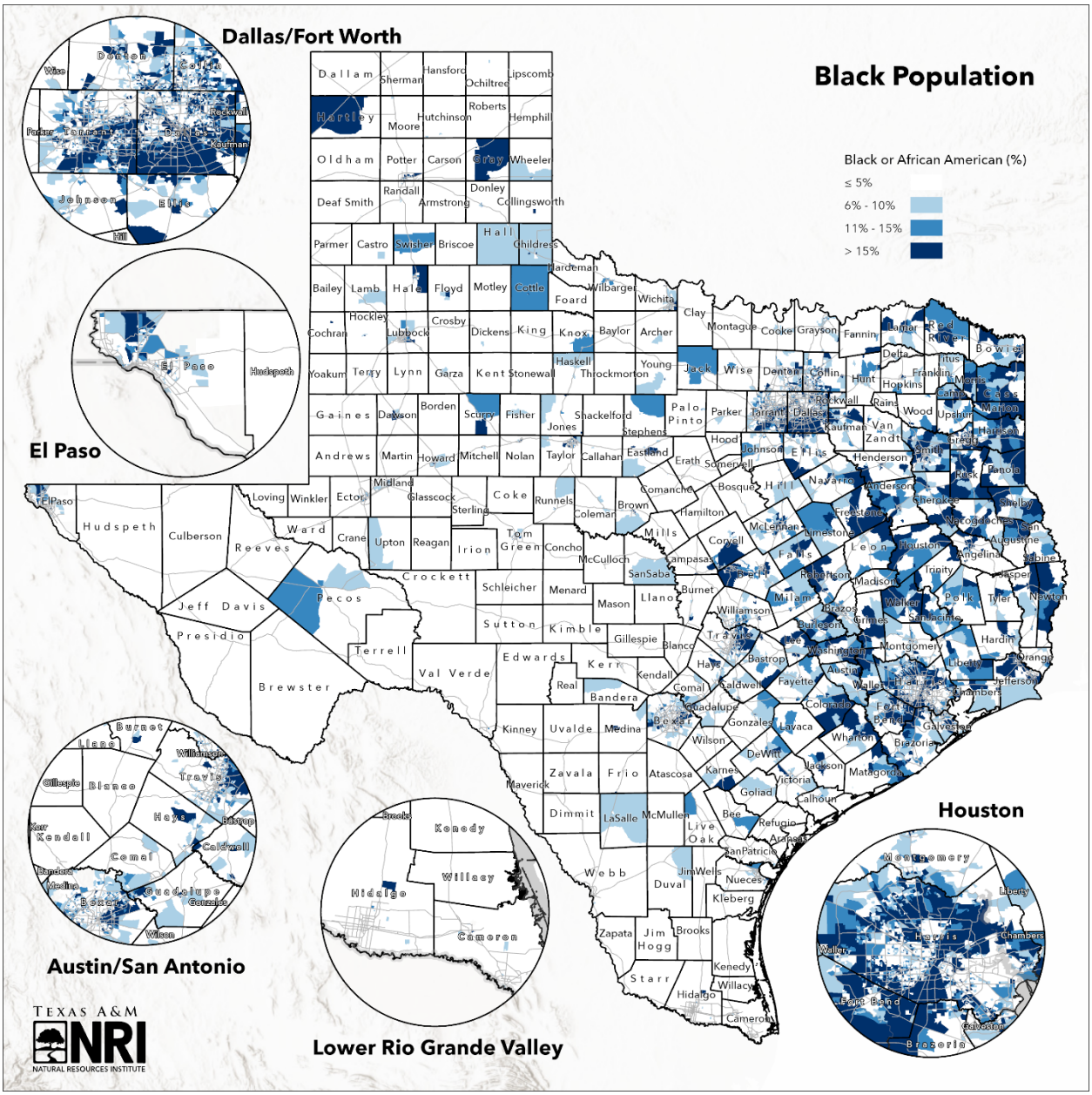


Figure 6. Percent Black or African American population by census block group in Texas. Source: U.S. Census Bureau.

Likewise, the 3.8% of people identifying as “Asian Alone,” live across Texas, with larger population hubs outside Dallas and Houston (Figure 7).

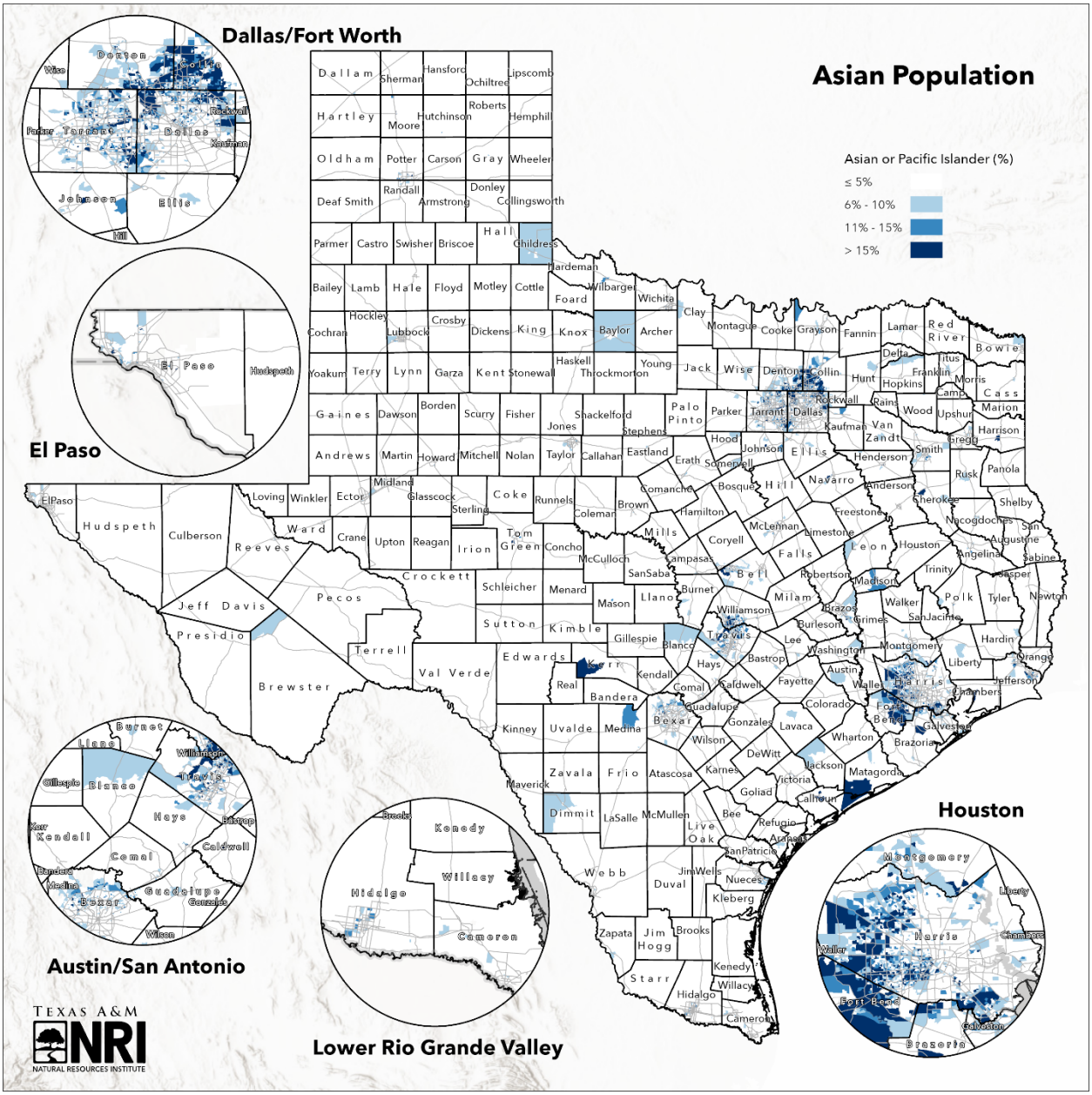


Figure 7. Percent Asian population by census block group in Texas. Source: U.S. Census Bureau.

Populations identifying as American Indian have representation in many counties across the state with higher populations in Navarro and Polk counties, East Texas and Maverick and Presidio counties in West Texas (Figure 8).

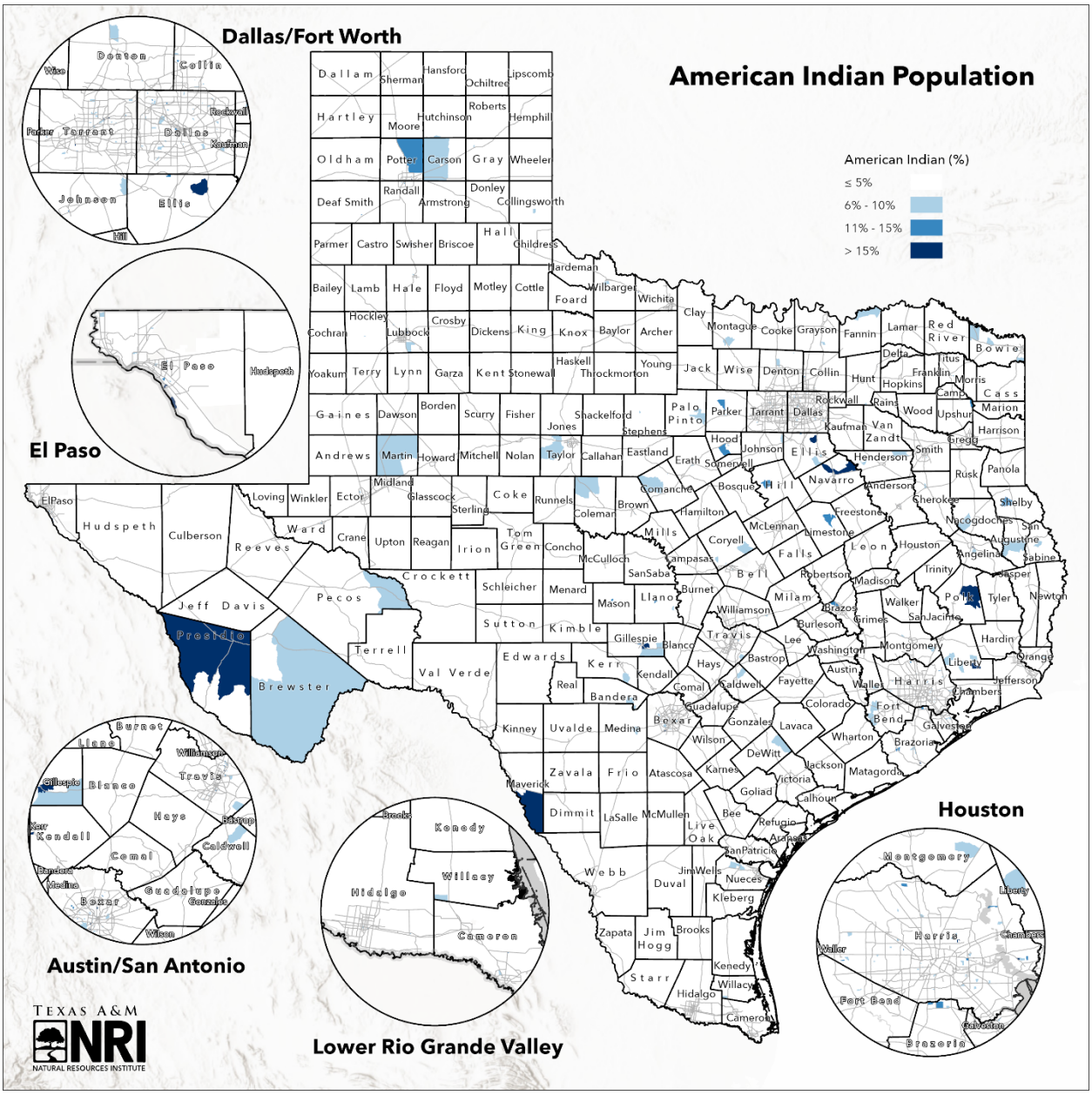


Figure 8. Percent American Indian population by census block group in Texas. Source: U.S. Census Bureau.

As a whole, Communities At-Risk (i.e., those who do not identify as white and are also not Latino, referencing non-Latino White), tend to be more concentrated in urban centers, relative to rural outskirts. This may be associated with workforce related opportunities in urban centers.

Poverty Level

The 2019 US Census American Community Survey (ACS) reports approximately 16% of people in Texas are in poverty, defined by the poverty threshold, which is defined on a yearly basis by the US Census Bureau. Anyone below the poverty threshold is in poverty. The poverty threshold considers the number of people in a household, the age of the people in the household, and the household income. For example, in 2019, a person living alone and under the age of 65 would need to make less than $13,300 a year to be considered under the federal poverty threshold. If that person has two children, the threshold goes up to $20,598 (Census Poverty Thresholds).

At the county level, poverty appears to be less of a factor in the central part of the state. The Lower Rio Grande region has an average population under the poverty line of 38%, well above the national average of 11%. Looking at the same variable at the census block level shows a detailed breakdown of the area (Figure 9).

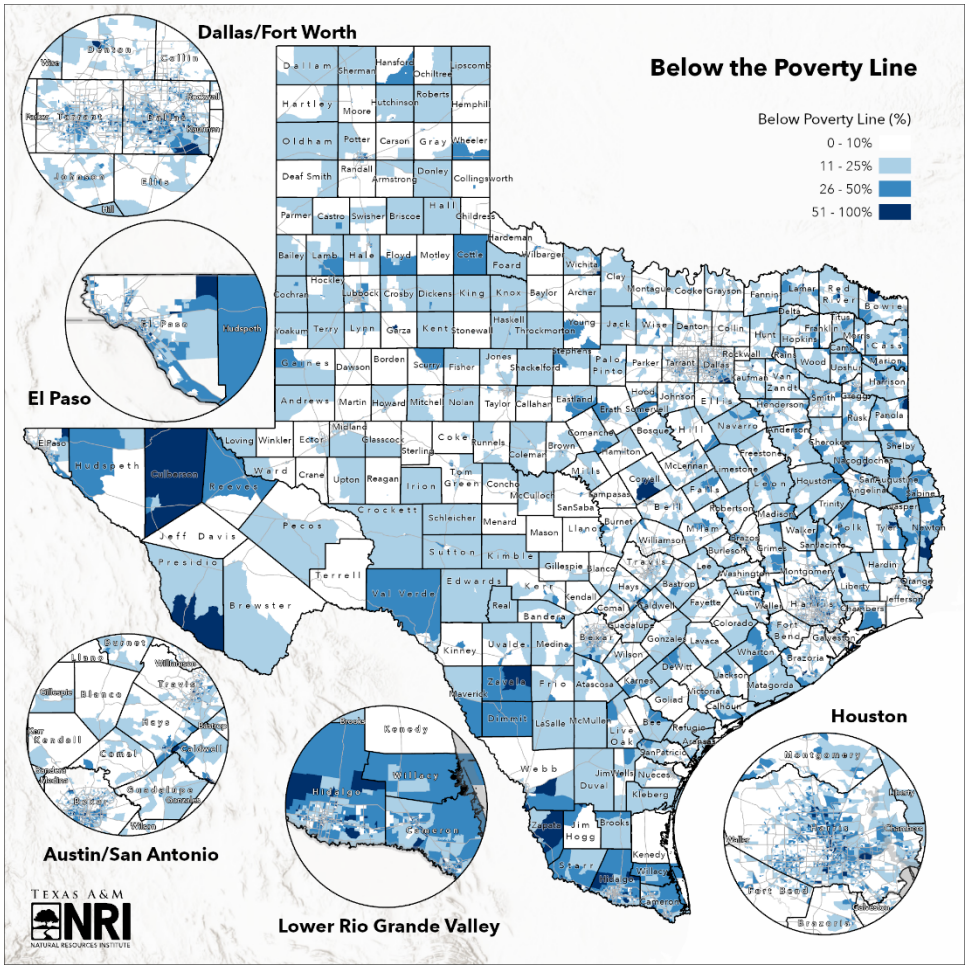


Figure 9. Percent population below the poverty line by census block group in Texas. Source: U.S. Census Bureau.

Another metric for understanding poverty is to look at thresholds based on the "Ratio of Income to Poverty" i.e., a percent above the poverty line. For example, the EPA considers people to be *low income* if the household income is less than or equal to twice the federal poverty threshold (EPA). Based on this definition of "low income", 38% of the state would be considered low income.

Low Income Populations seem to follow a similar trend. Again, the more poverty-stricken Lower Rio Grande region has a low-income population average of 59%, well above the national average. The two counties with the highest low-income populations are Presidio and Zavala, both at 65% (Figure 10).

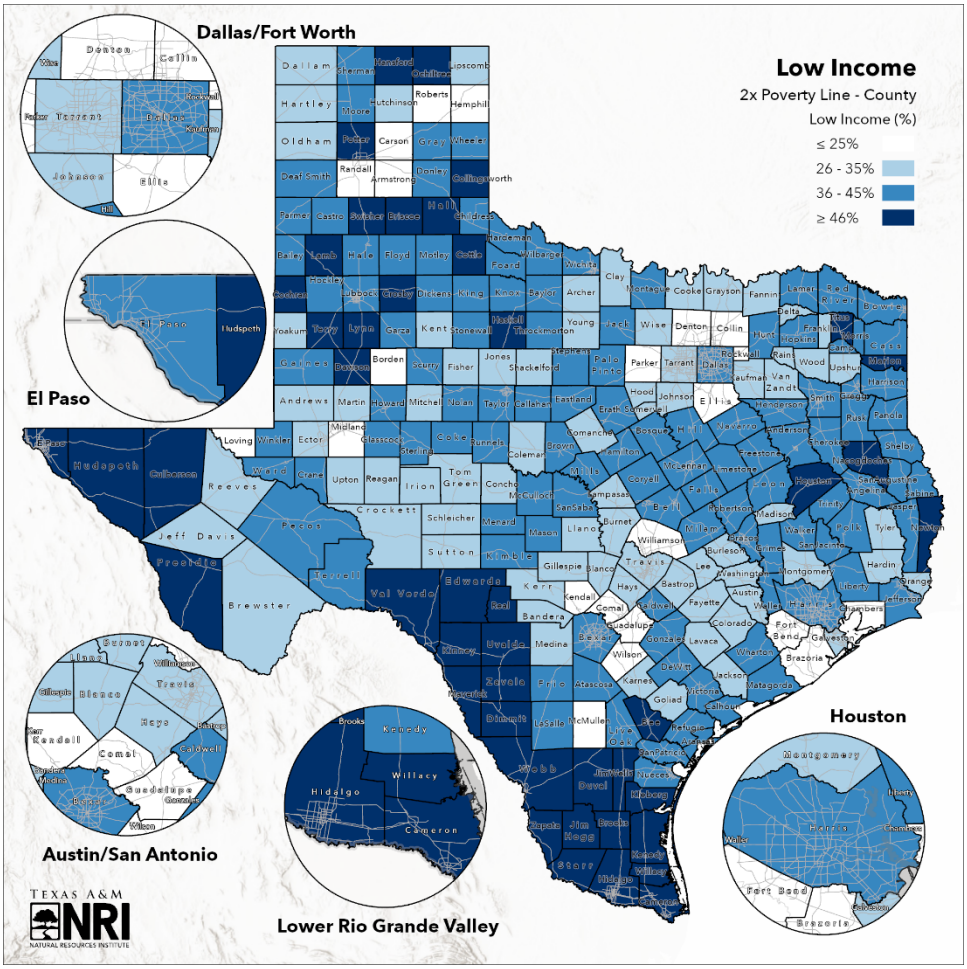


Figure 10. Percent population considered low income (2x above the poverty line) by county in Texas. Source: U.S. Census Bureau.

At the census block group level, a more nuanced picture emerges – poverty levels can vary drastically from neighborhood to neighborhood within counties. For example, in Uvalde, one census block group with 55% of the population considered low income borders a census block group of a similar size where only 33% of the census block group is considered low income. Another trend that emerges when looking at low-income communities is that they tend to be concentrated in more urban areas and town centers (Figure 11).

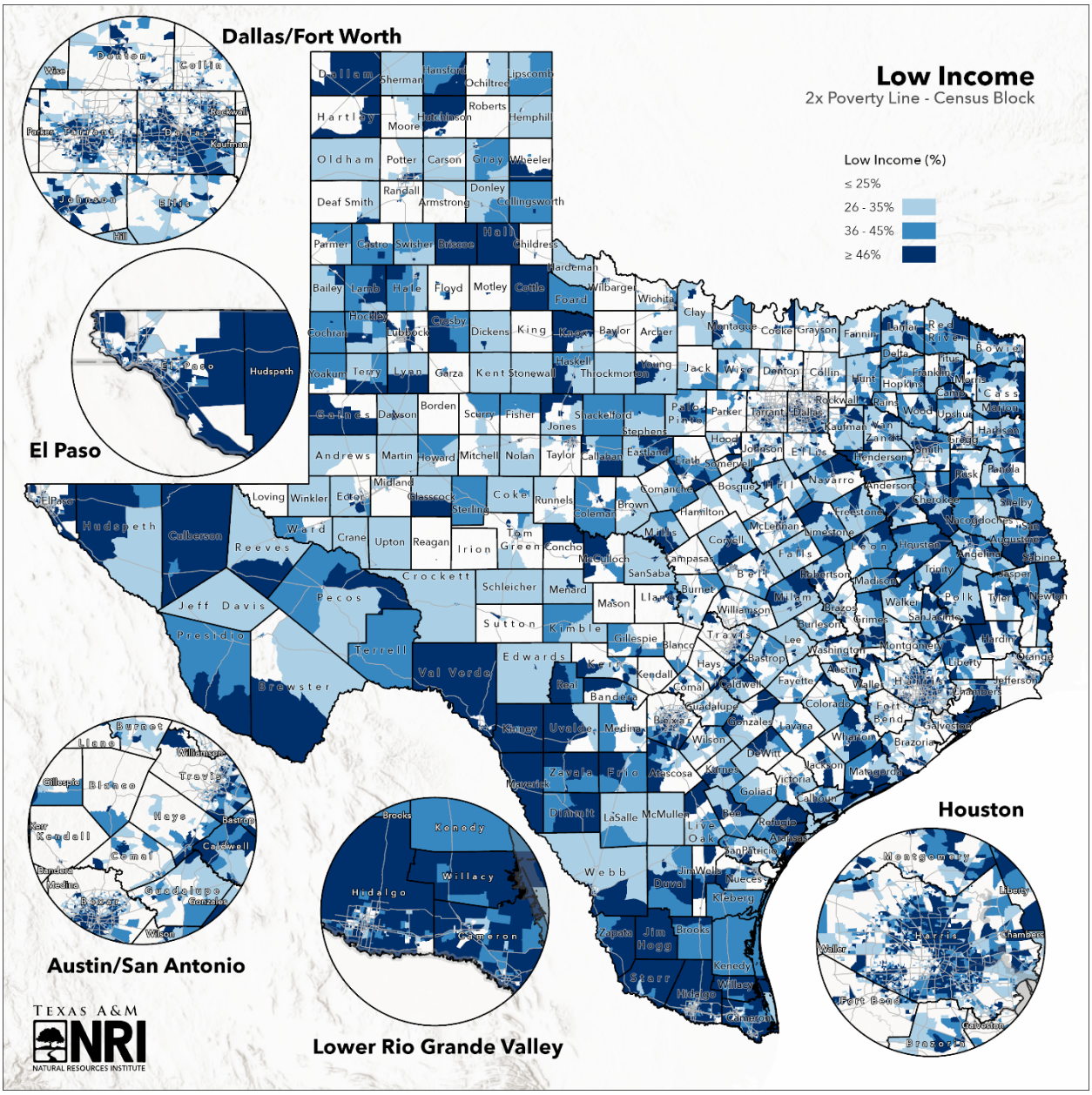


Figure 11. Percent population considered low income (2x above the poverty line) by census block group in Texas. Source: U.S. Census Bureau.

Median Income

Mapping median income at the county level, a clear and perhaps unsurprising pattern emerges – median income is higher in the sub-urban counties around major cities and is also higher in the Midland-Odessa region. Rural counties tend to have lower median income levels than urban centers (Figure 12). The Texas Water Development Board uses Median Income to help determine whether a community is considered an "Economically Distressed Area" (EDA) eligible for financial assistance through the Economically Distressed Areas Program (EDAP). EDAs must have "median household income less than 75 percent of the median state household income" (TWDB). In 2019, the median household income (2015-2019) was $65,591, so the 75% cutoff was $49,193 (Source: Census.gov). Based on this threshold, several counties across the state would qualify for financial assistance. Though EDAs are determined on the municipal level, county-level income could be a good indicator for EDAP qualifying areas in the more rural parts of Texas.

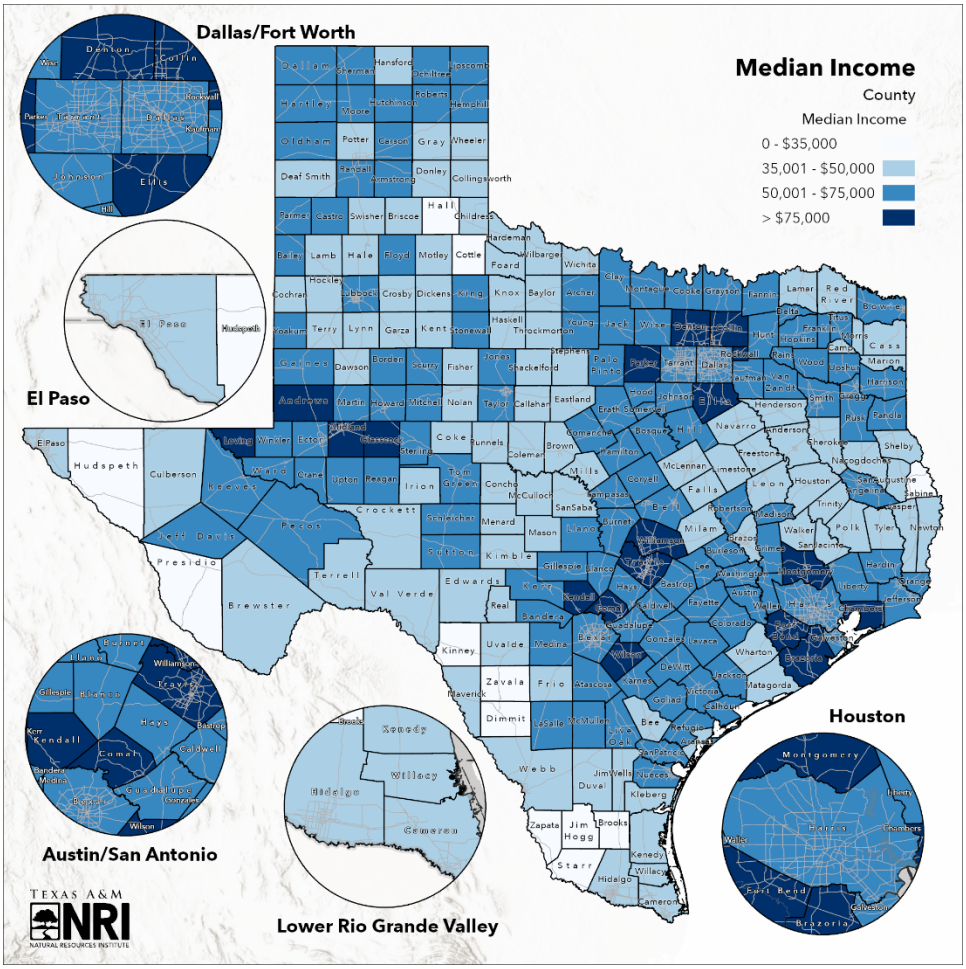


Figure 12. Median income ($) by county in Texas. Source: U.S. Census Bureau.

When compared with the county map, median income at the census block level only emphasizes the data from the county level and more specifically indicates where within

counties each median income level group is located. Median income in sub-urban areas around major cities, in the Midland-Odessa region, and in rural counties is seen in more detail (Figure 13).

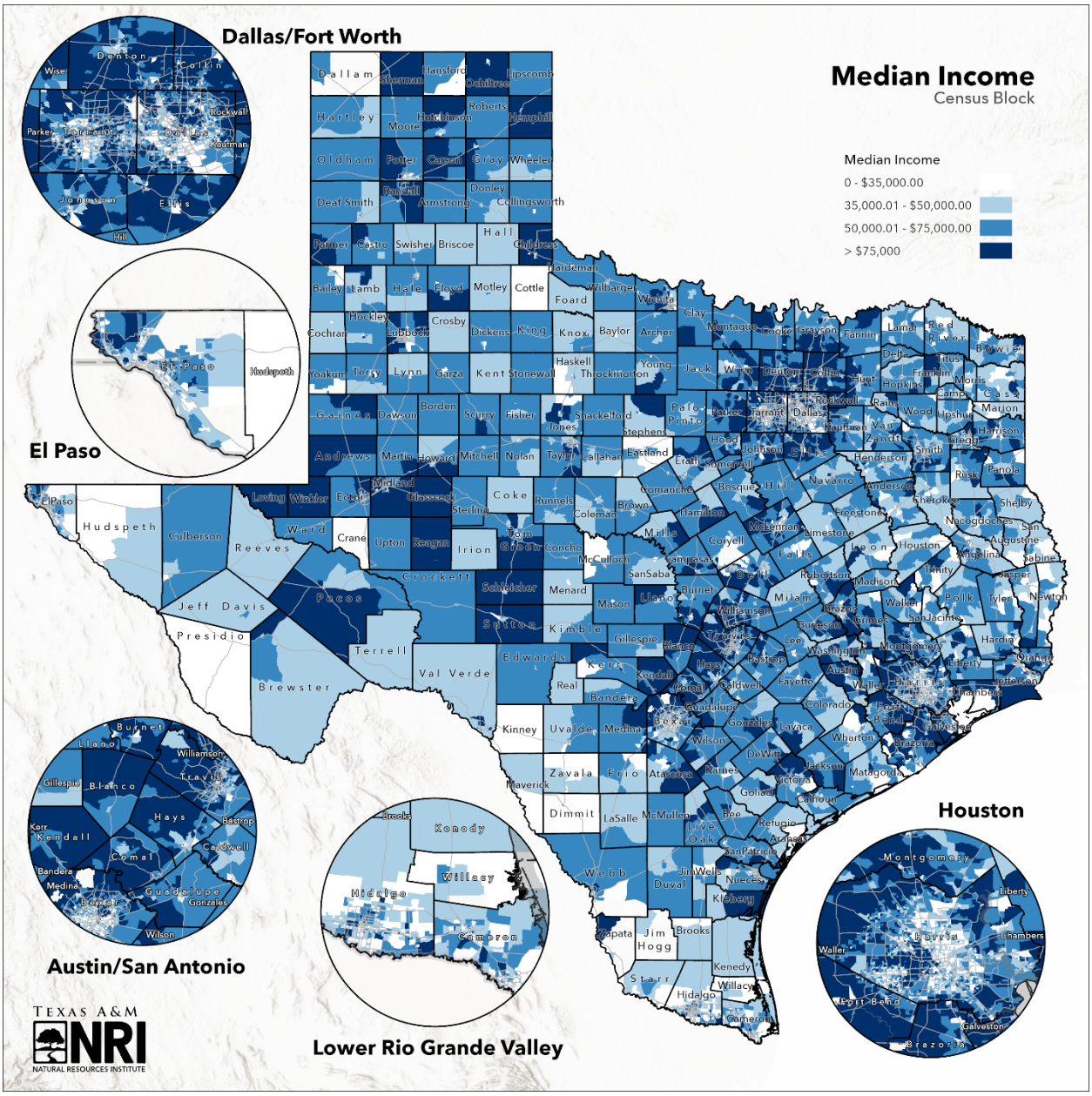


Figure 13. Median income ($) by census block in Texas. Source: U.S. Census Bureau.

Unemployment Rates

Unemployment rates fluctuate constantly in Texas. In 2019, the rate was 5.1%, which is just lower than the national unemployment rate of 5.3%. The highest unemployment rates in the state are located near Corpus Christi, Houston and San Antonio. The majority (58%) of the state has a rate less than 5% (Figure 14)**.** The unemployment rate measures the percent of people in the labor force (i.e., those that are employed or actively looking for work) that currently do not

have a job. It is important to note that unemployment numbers do not include discouraged workers who are no longer in the labor force, or retirees.

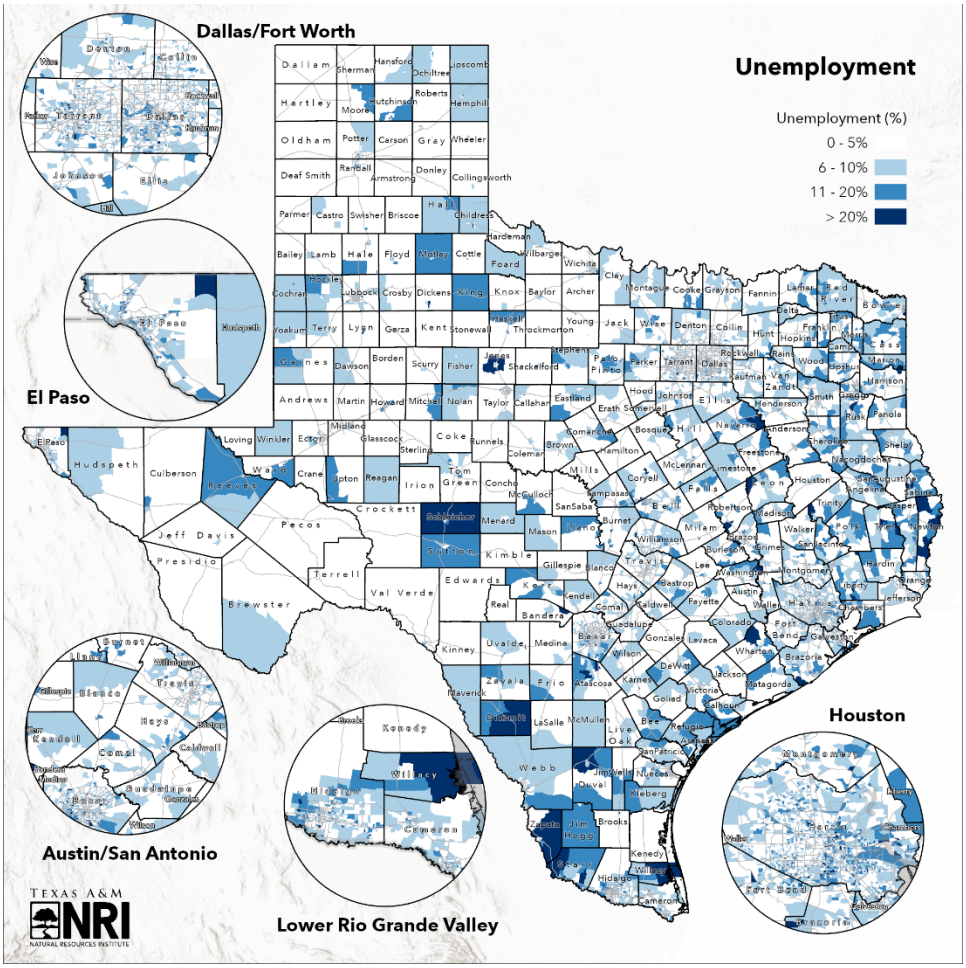


Figure 14. Percent unemployment by county in Texas. Source: U.S. Census Bureau.

Labor Force

The labor force participation rate is the proportion of people in the labor force (employed or actively looking) out of the total civilian noninstitutional population age 16 and over. In other words, the labor force participation rate tells you the percentage of people that are employed or actively looking out of the total number of people eligible to work. A low labor force participation rate could indicate high numbers of retirees, high numbers of students, or high numbers of discouraged workers. Unfortunately, current data on labor force participation is not available at the county level.

According to the US Bureau of Labor Statistics, Texas' labor force participation rate (percentage of people in the labor force) in 2019 was 63.7%, just above the national average at 63.6%. The highest participation rates are around Dallas and Houston.

Table 3. Adults in Labor Force by Sex in Texas.

Sex	Total (%)	People 15 and over in the Labor Force (%)
Male	14,221,720	
	49.70	38.70
Female	14,413,722	
	50.30	39.80

*ACS 2020 5-Year Estimates (Methodology)

Education

Among the state's population, 30.8% of Texans are college educated, which is lower than the national average of 37.9%. Also, on average, 19% of people in Texas never graduated from high school, compared to 8.9% at the national level. Although lower high school graduation rates are found in the Lower Rio Grande Valley, these rates vary dramatically on a county-by-county basis (Figures 15-16).

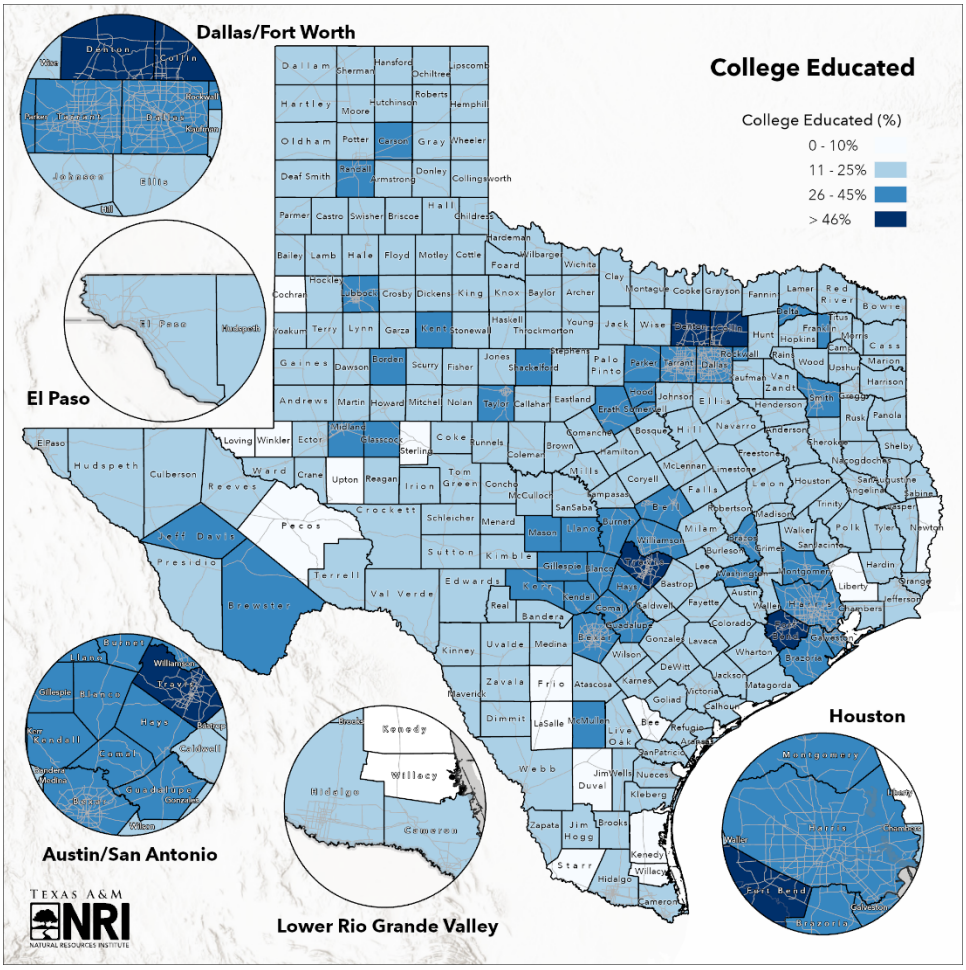


Figure 15. Percent population with a college education by county in Texas. Source: U.S. Census Bureau.

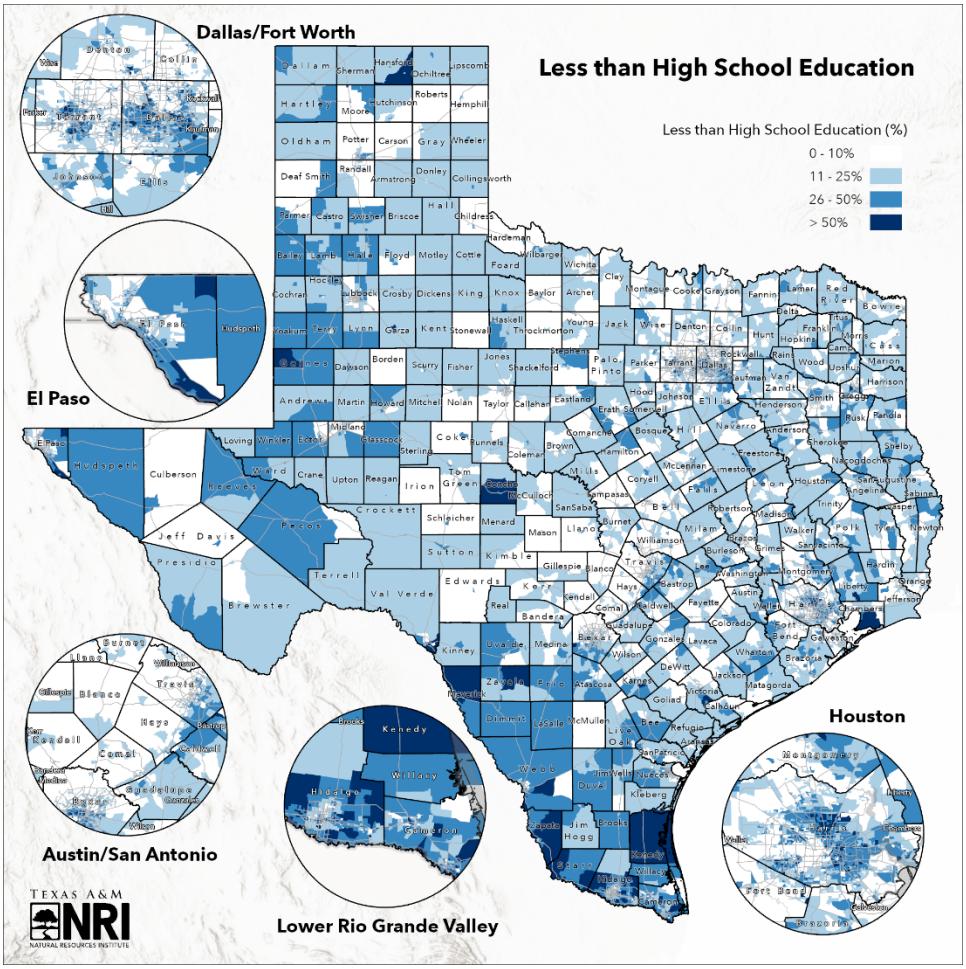


Figure 16. Percent population with less than a high school education by census block group in Texas. Source: U.S. Census Bureau.

Linguistic Isolation

According to the EPA, households experiencing linguistic isolations are those in which "all members age 14 years and over speak a non-English language and also speak English less than 'very well' (have difficulty with English)" (EPA). With the exception of the Lower Rio Grande Valley and many western counties with pockets of isolated communities in major cities, linguistic isolation does not appear as prevalent across the state (Figure 17).

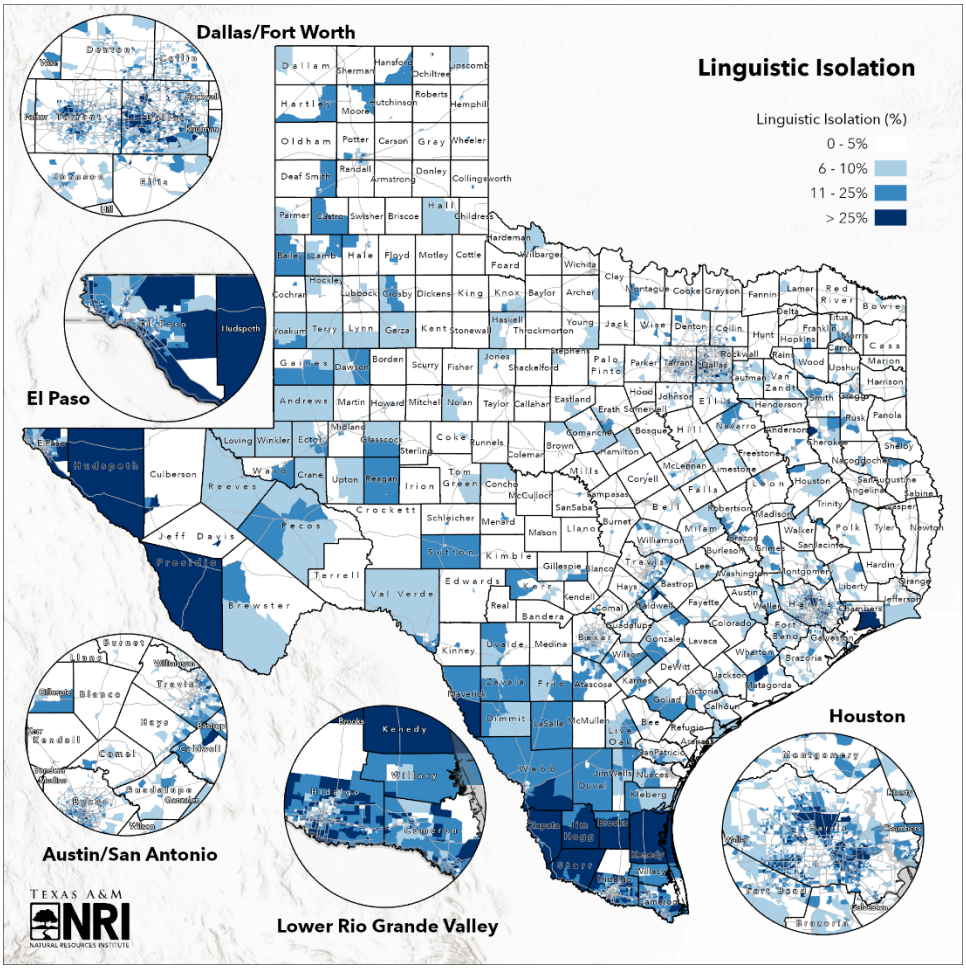


Figure 17. Percentage of households in linguistic isolation by census block group in Texas. Source: U.S. Census Bureau.

Landowner Demographics

Rural working lands provide many ecosystem benefits to surrounding communities, and land stewardship is key to imparting those benefits. Land ownership trends in Texas have changed little since land was transferred from indigenous and Mexican hands to European and European-American hands. Current landownership can be described within three metrics: operations, producers, and acres operated. The USDA defines an *operation* as "any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the year." They define a *producer* as the person designated to make management decisions regarding the land and/or operation. The *acres operated* involve the land base of the operation, in this case, the acres managed or owned.

Most farms across the United States are family-owned businesses. Based on the 2017 Agricultural Census, we describe the demographics of Texas operations, producers and acres operated. In terms of Texas operations, 15% are owned or managed by Communities At-Risk (Hispanics or Latinos, Black or African Americans, American Indians or Indigenous groups, and Asian Americans) and 85% by non-Hispanic Whites. Of Texas producers, 13% of rural lands are owned or managed by Communities At-Risk, meaning 87% of ecosystem service benefits are controlled by Non-Hispanic Whites. With respect to acres operated in Texas, 8% were operated by Communities At-Risk and 92% by Non-Hispanic Whites. Most producers were male, but not overwhelmingly so, and over the age of 35, with only 5% below the age of 35 (Figure 18). Hispanics represented the largest number of producers for Communities At-Risk (Figure 19).

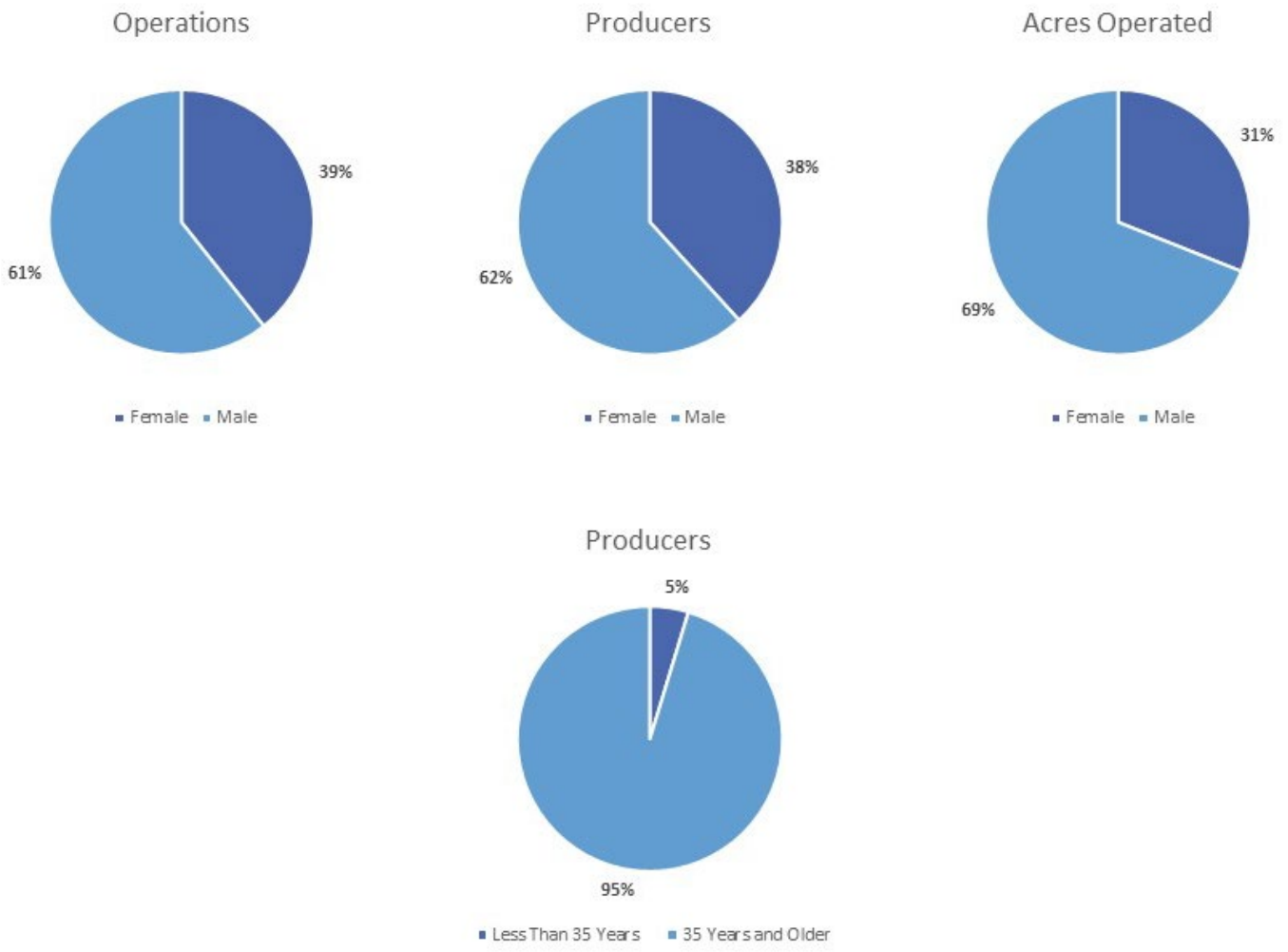


Figure 18. Sex and age by operations, producers, and acres operated of rural working landowners in Texas. Source: USDA, NASS, COA.

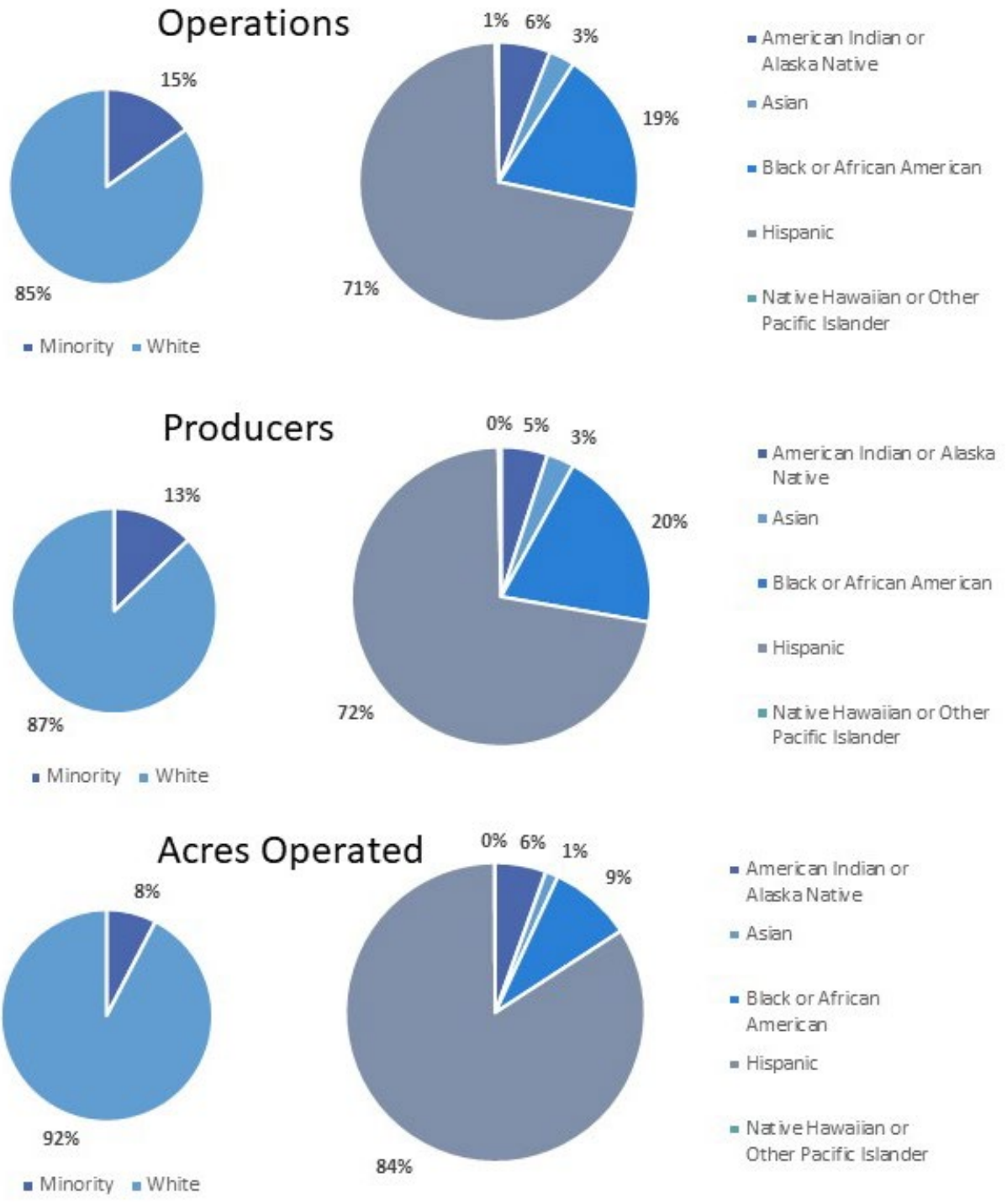
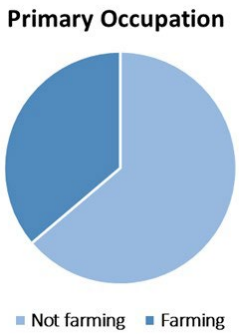
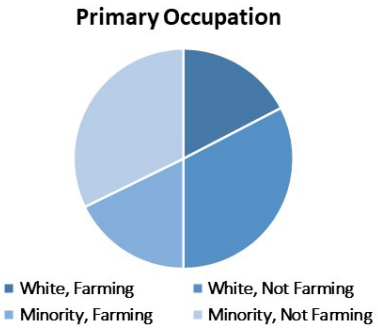
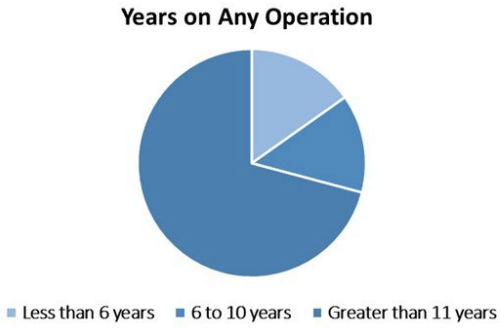
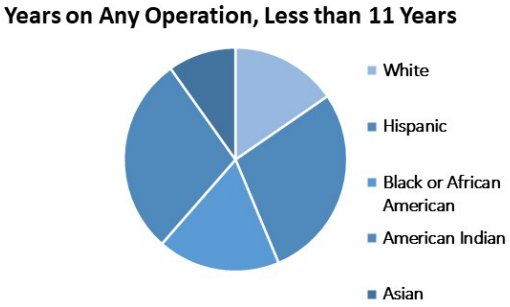


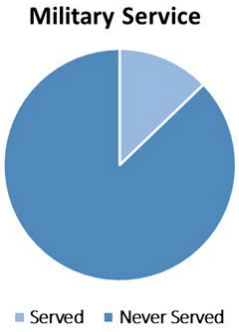
Figure 19. Race and ethnicity by operations, producers, and acres operated, primary occupation, years on any operation, military service, and residence of rural working landowners in Texas (Left chart: White vs. Minority; Right chart: Minority only). Source: USDA, NASS, COA.

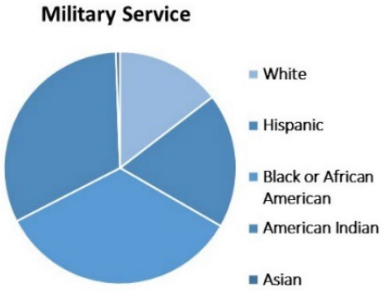












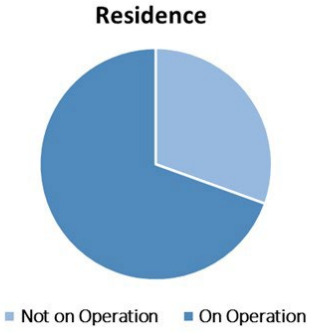


Figure 19. cont.

Policymakers Demographics

Texas consists of 254 counties with approximately 29.5 million residents, of which 13% are Black or African American, 1% American Indian or Indigenous, 6% Asian, 40% Non-Hispanic White and 40% Hispanic or Latino (US Census 2021). Texas is almost evenly divided between male and female. In an effort to compare sex and ethnicity collectively, pie charts were created for water and county leadership, each describing sex on the right half of the pie chart (male and female) and race and ethnicity on the left half of the pie chart (Non-Hispanic White, Black or African American, American Indian, Hispanic/Latino, and Asian). Figure 20 provides a demographic snapshot of the total Texas population and illustrates sex (right half of pie chart) and race and ethnicity (left half of pie chart). This pie chart format will be used to describe the demographic characteristics of water leaders, county leaders, and county populations.

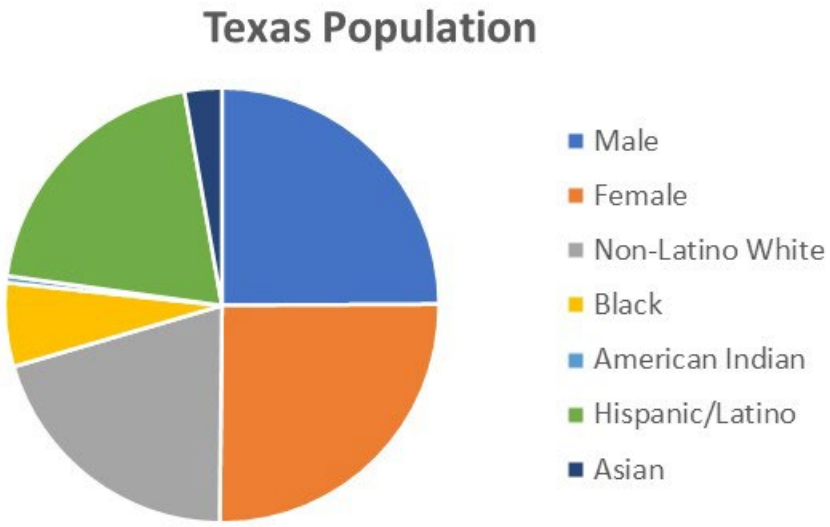


Figure 20. Collective Texas general population demographics. Source: US Census.

Water leader positions, to include staff and appointees, for purposes of this analysis, describe groundwater conservation districts, river authorities, the Texas Water Development Board and regional water planning groups (Figure 21). One position for each groundwater conservation district was evaluated (180 positions total, 74 unfilled positions or 29% of positions). Thirty river authority positions were evaluated (2 positions per 15 authorities). Twelve Texas Water Development Board positions and 32 positions for regional water planning groups (2 positions per 16 planning groups) also were evaluated. In assessing water leadership, most leadership positions were held by white males, with the exception of the Texas Water Development Board, which was more representative of statewide demographics. A few water leadership positions could not be determined. This was factored into the assessment, and each group was assessed independently.

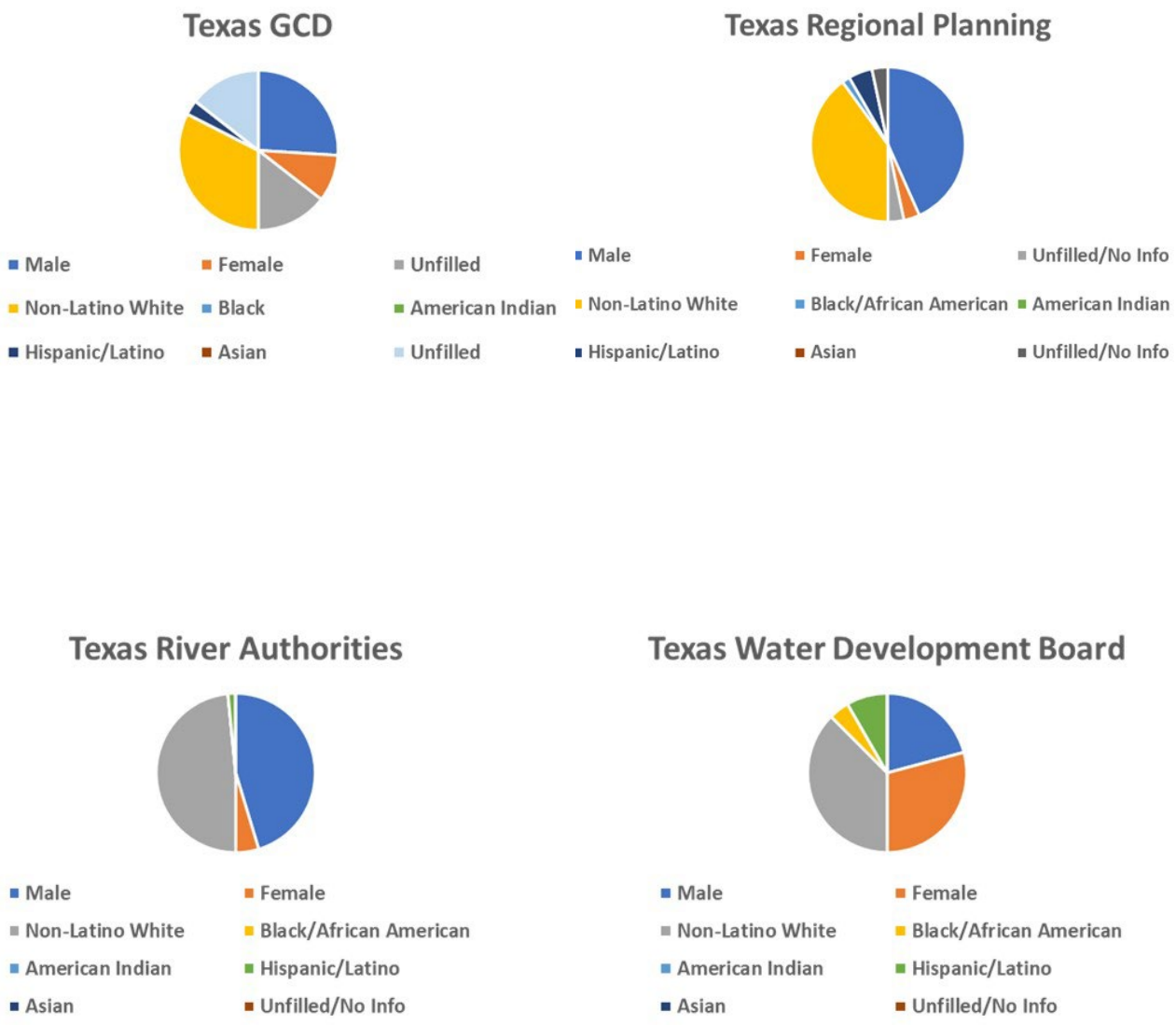


Figure 21. Demographics of Groundwater Conservation Districts, River Authorities, Texas Water Development Board and Regional Planning Groups.

County leader positions, to include elected and non-elected positions, also were assessed (Figure 22). An additional chart was created for each county, depicting general county population demographic characteristics and allowing a side-by-side comparison of county leadership and county demographics. County leader positions averaged at 20, with a range of 13 to 31 positions per county. In assessing county leadership positions, a few positions could not be determined. This was factored into the assessment. Many county leaders across the state were female. Counties, such as Bexar, Border, Brazos, Brewster, Burnet, Clay, Crane, Culberson, Delta, and Duval, among several other counties across the state, were comparatively

representative of their respective county population demographics. Latino, Black, American Indian and Asian American community groups were not as well represented. Among these community groups, Latinos held the most leadership positions, followed by African Americans.

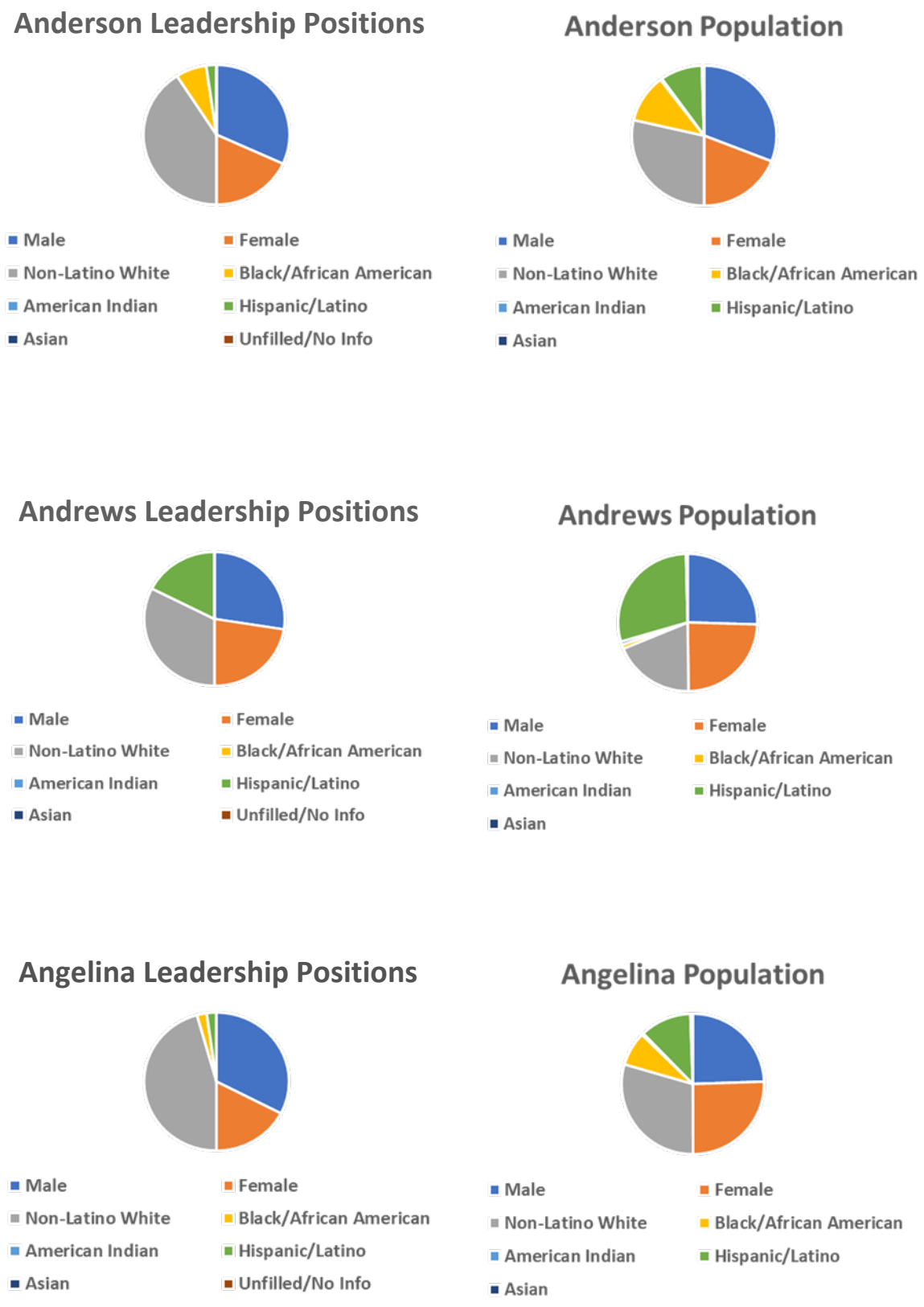
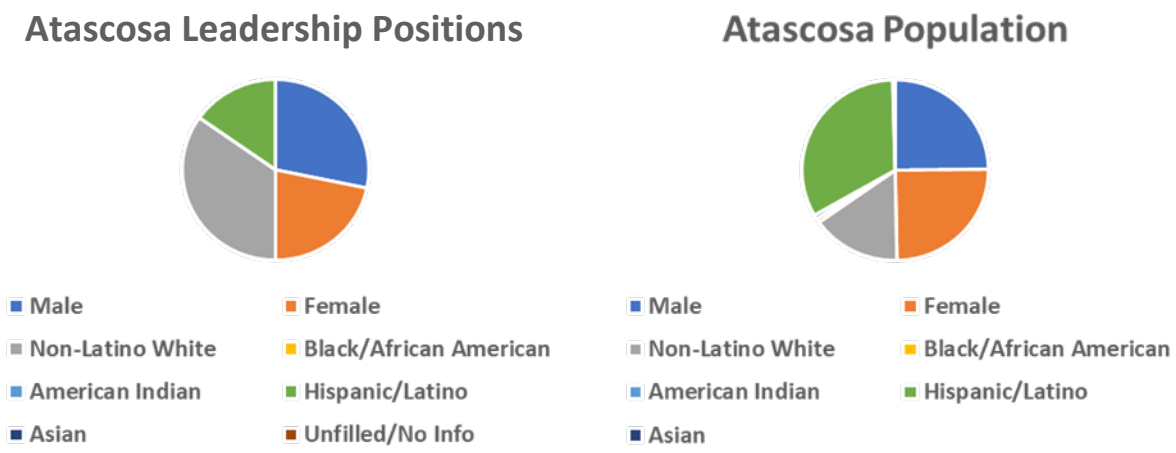
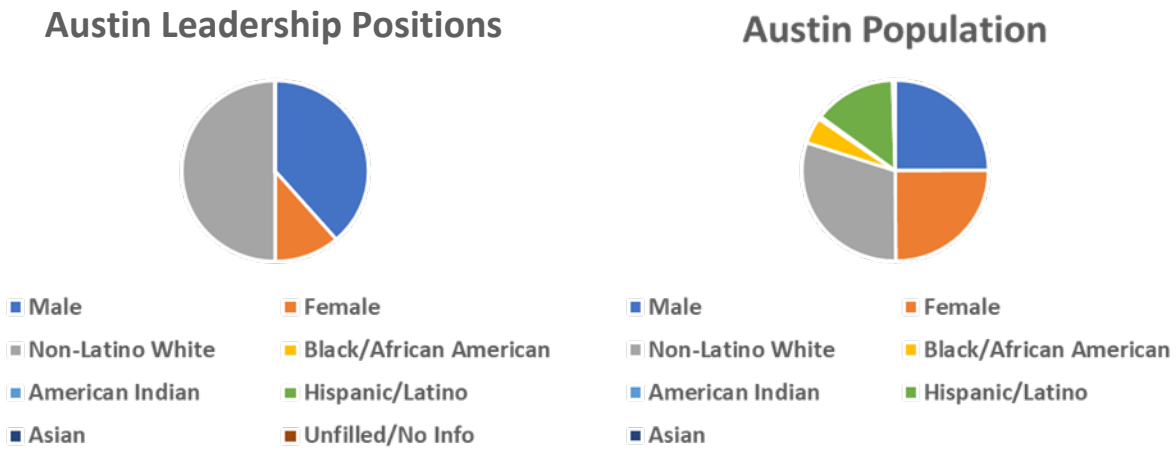
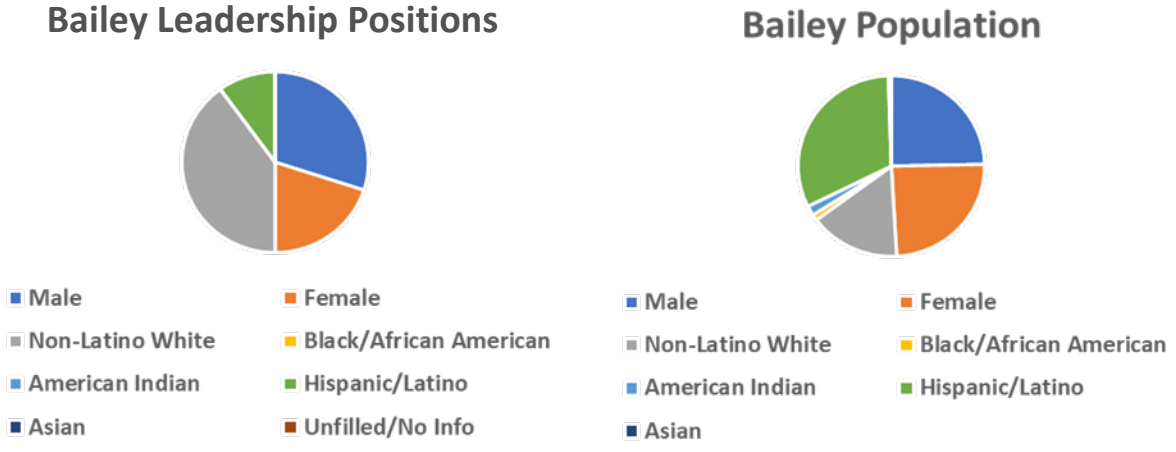


Figure 22. Elected county officials compared with general county demographics. Source: US Census.







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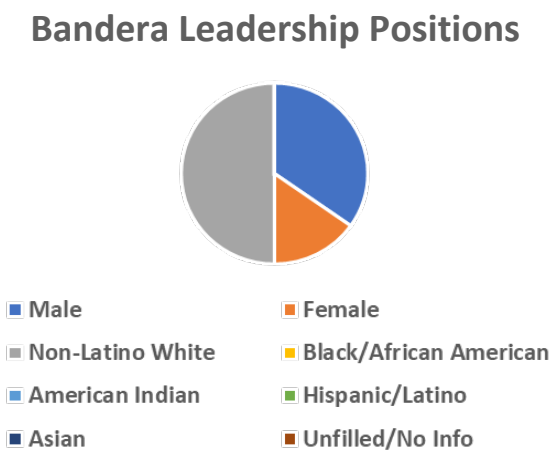

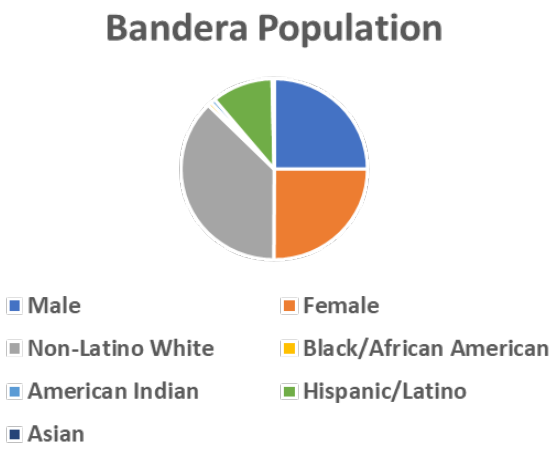

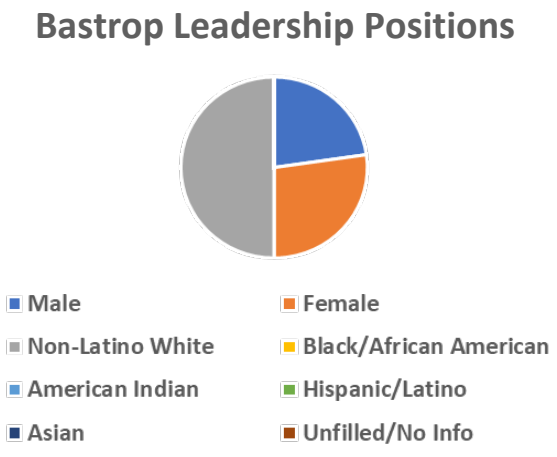

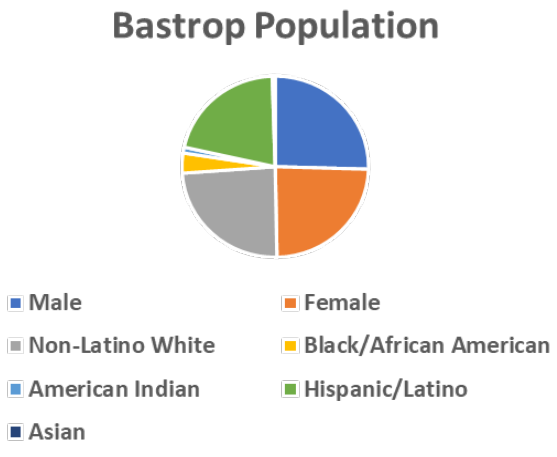

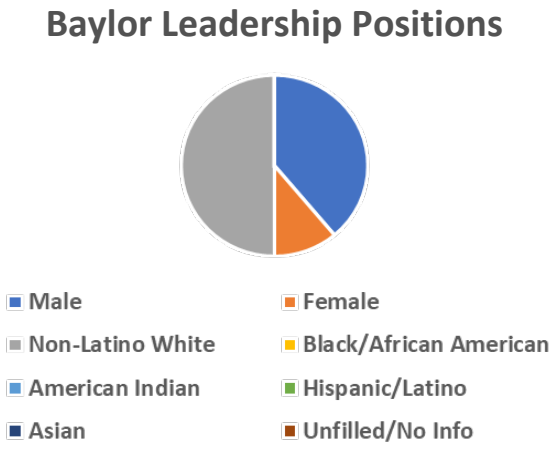

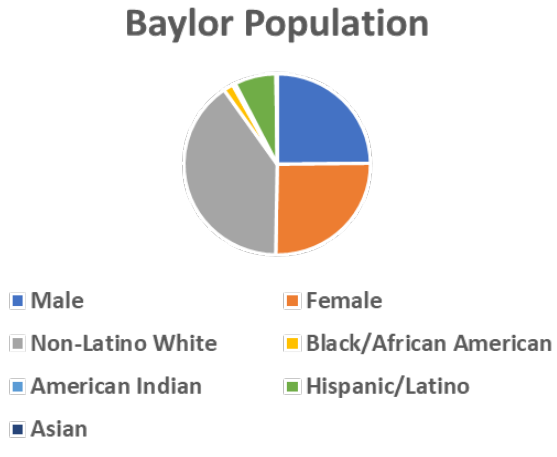

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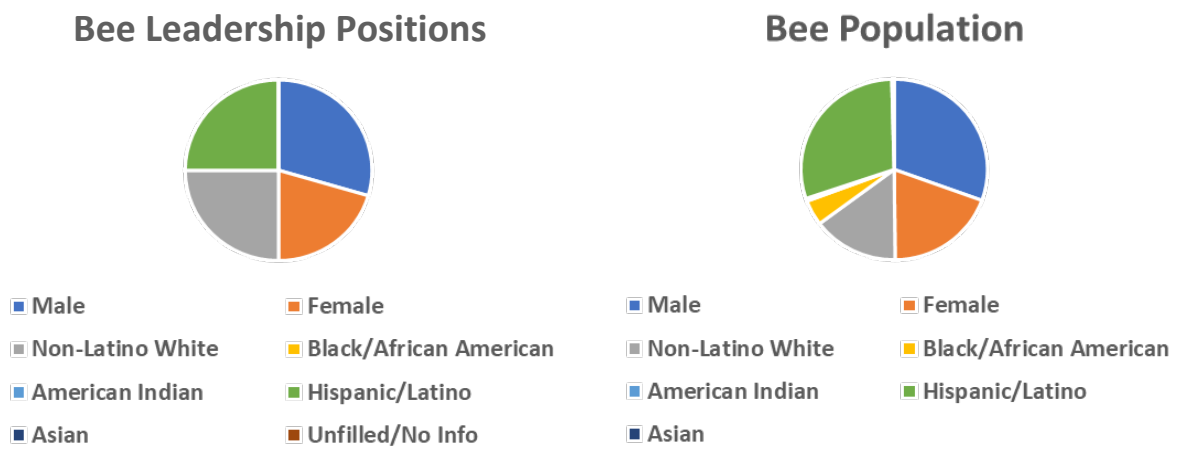

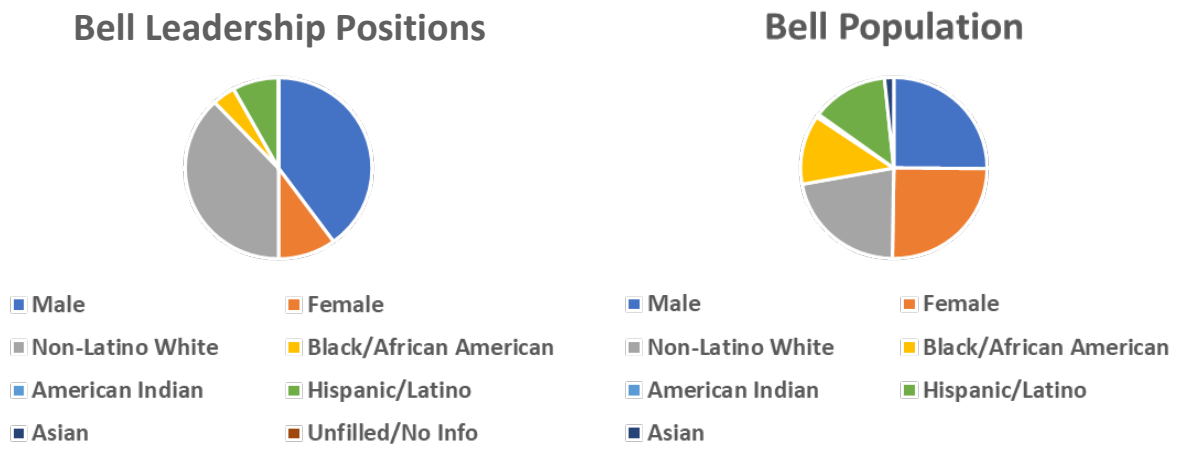

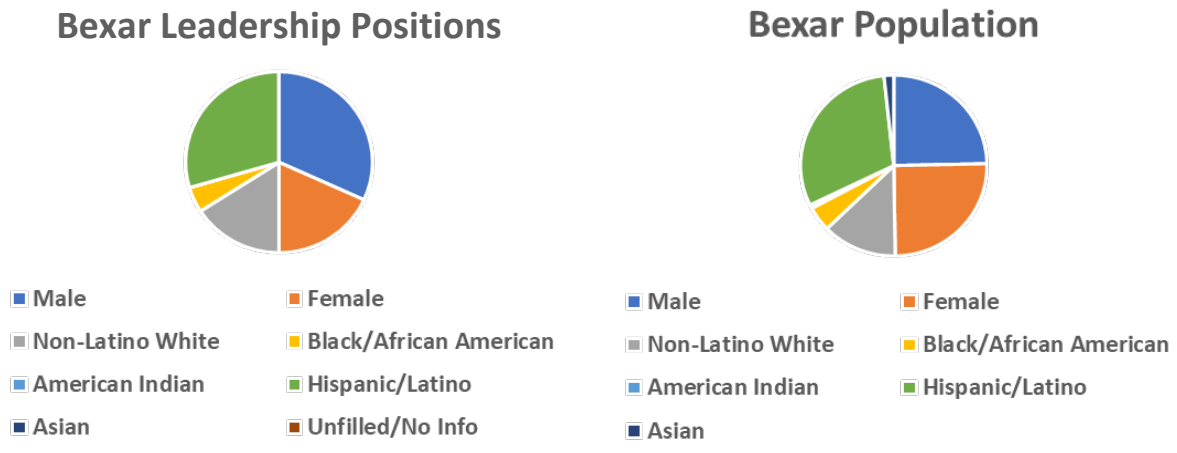

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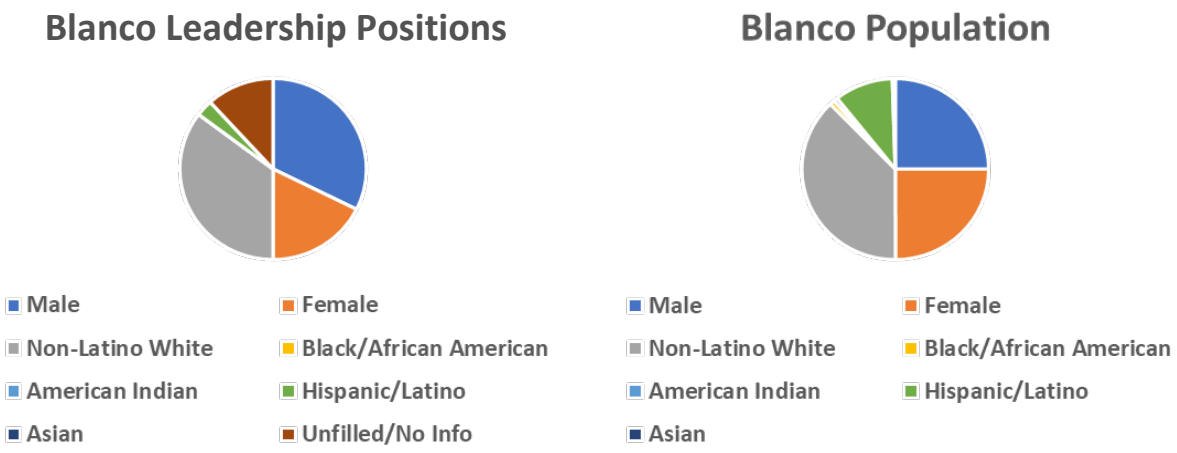

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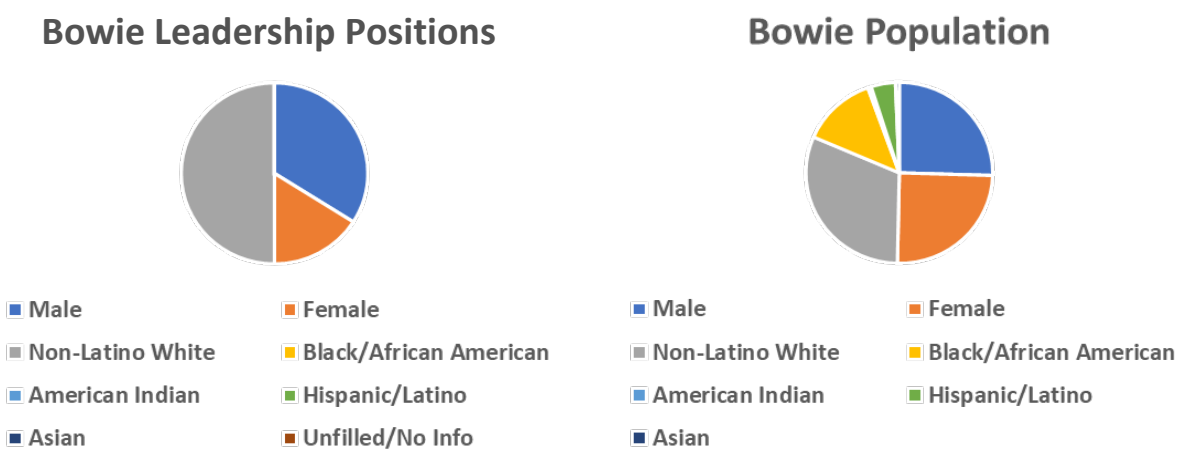

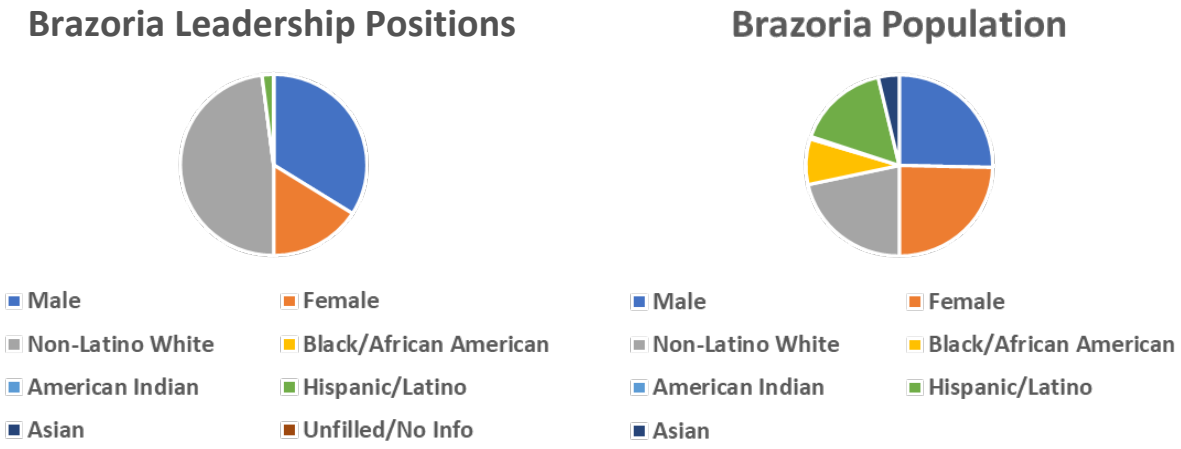

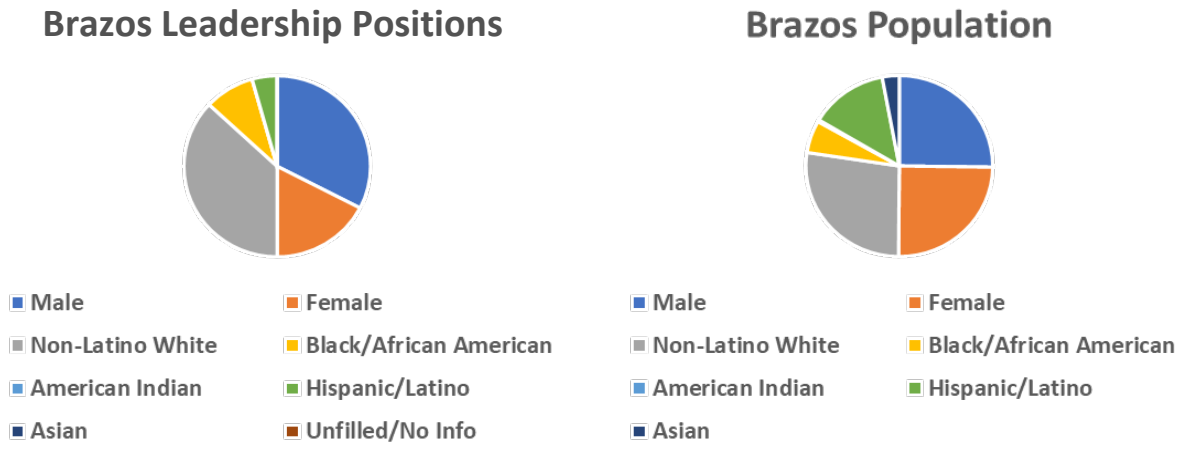

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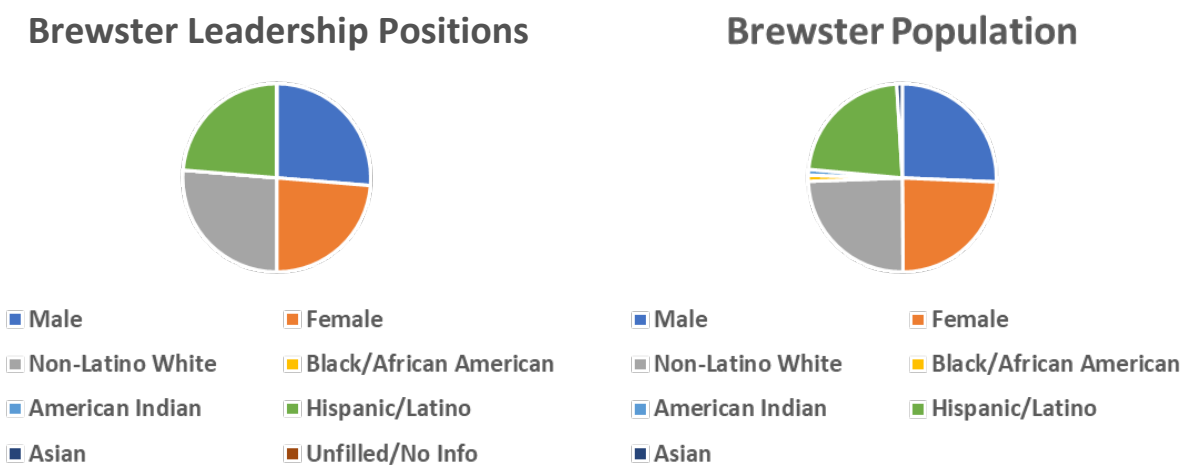

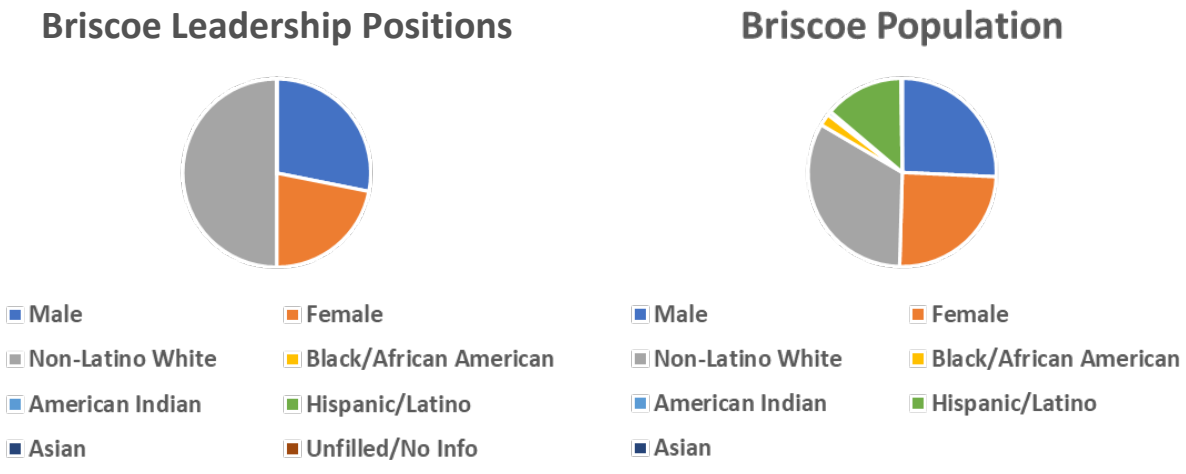

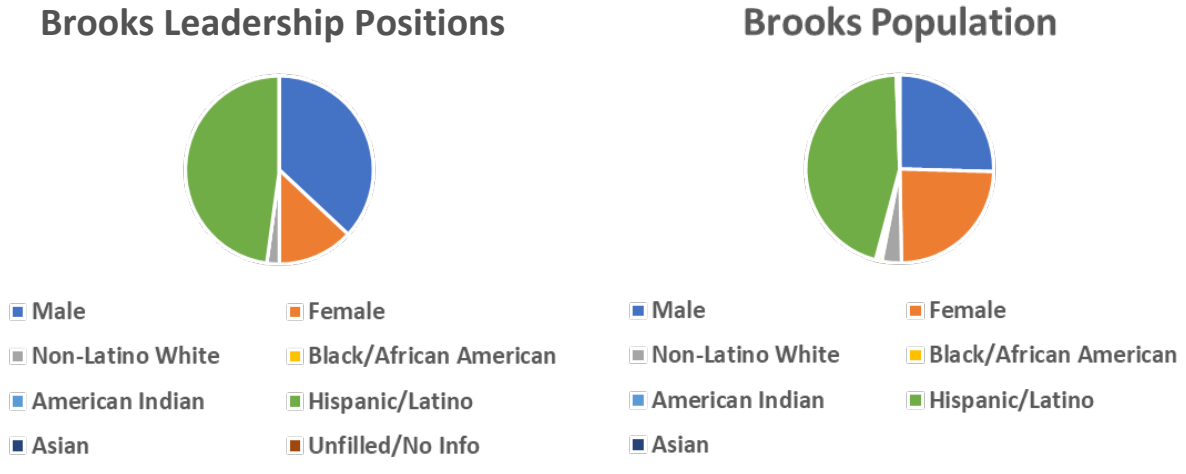

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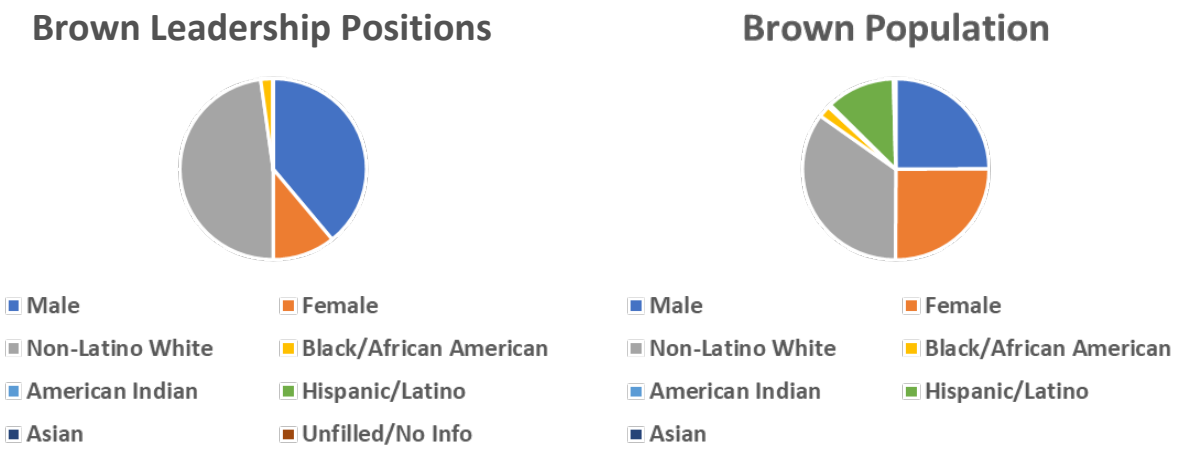

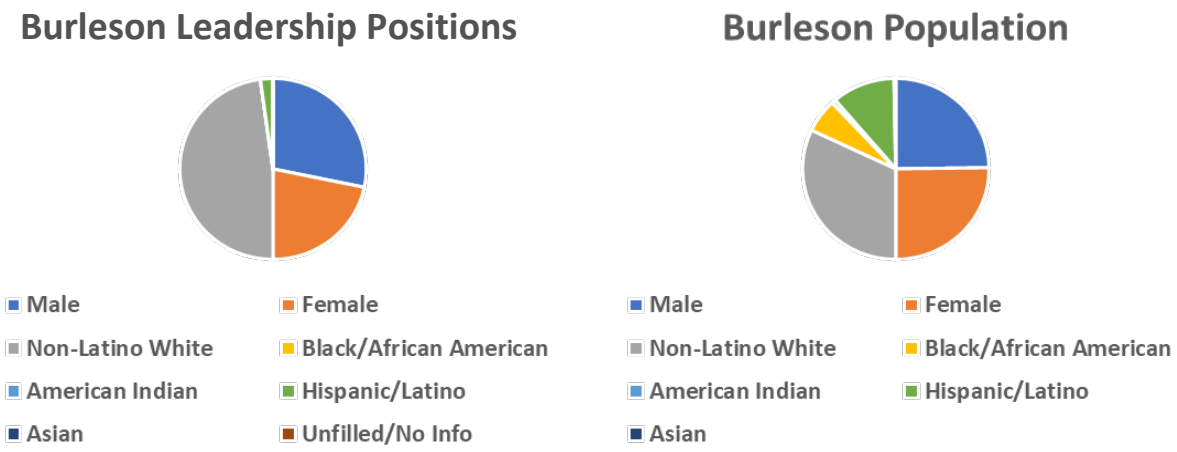

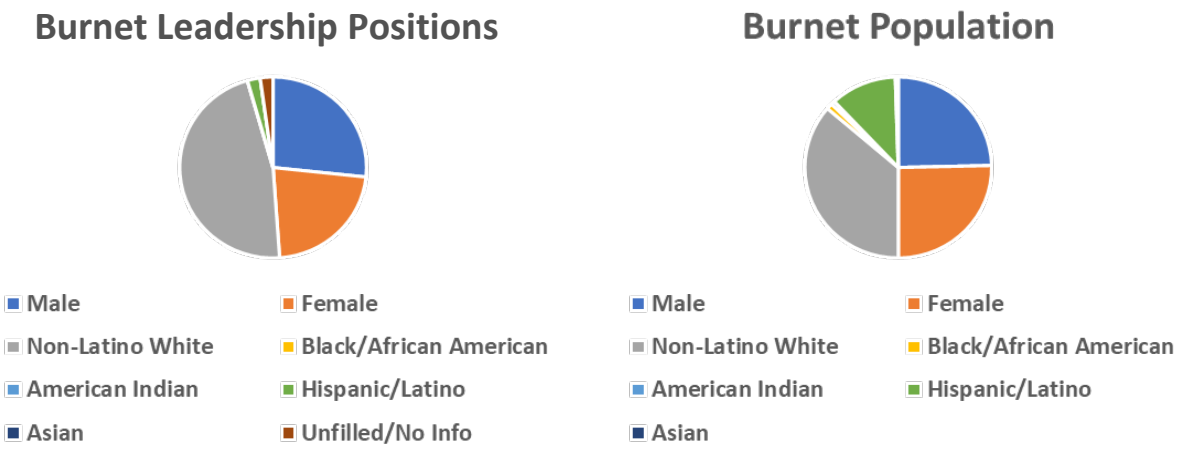

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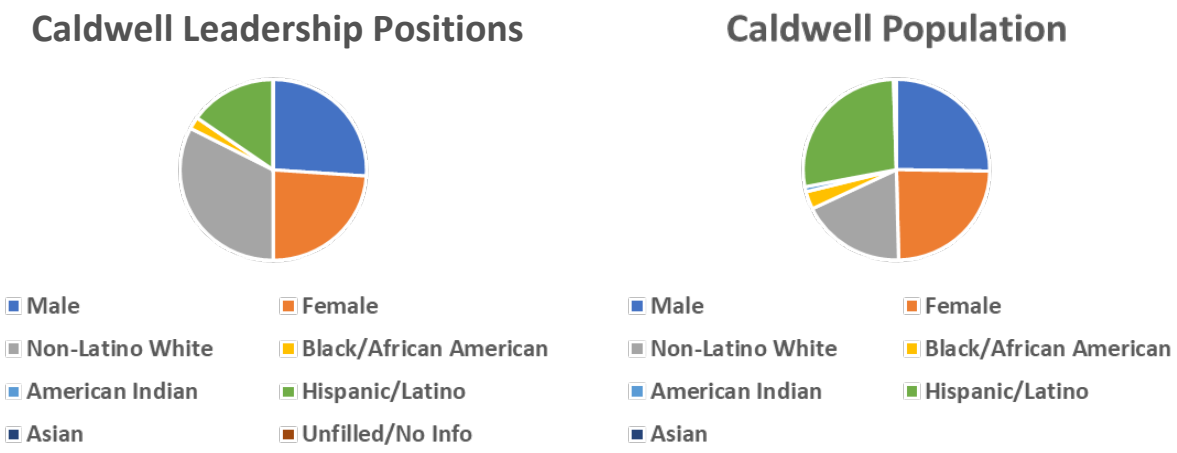

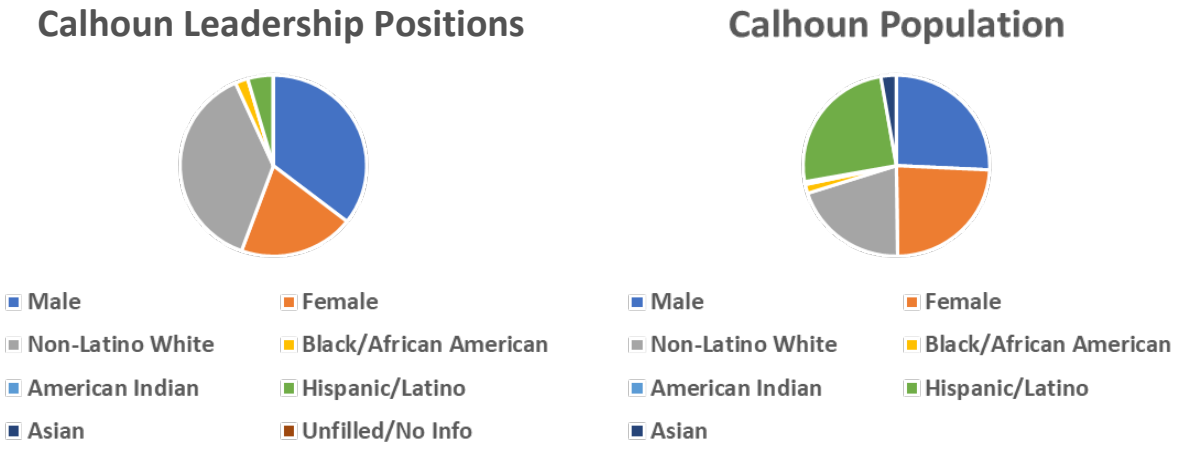

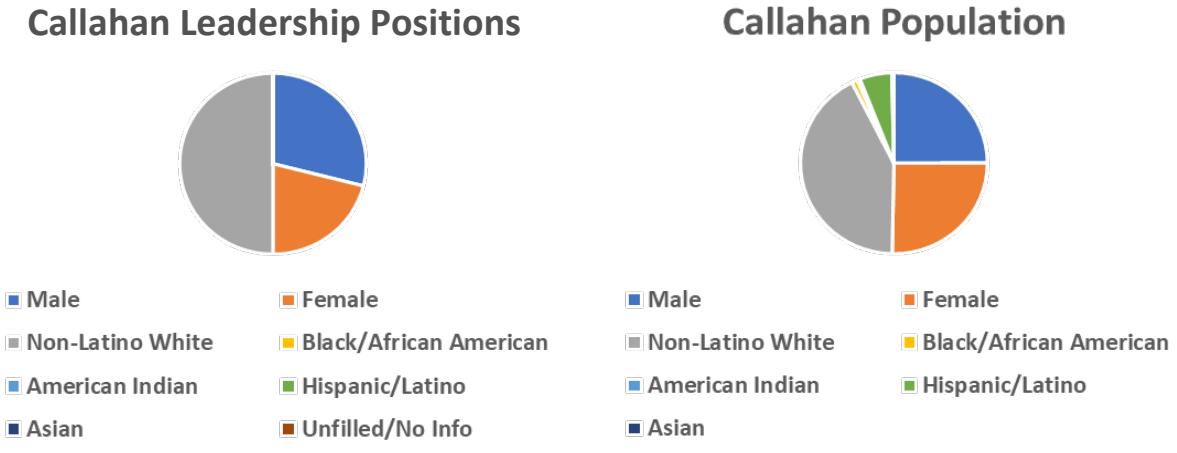

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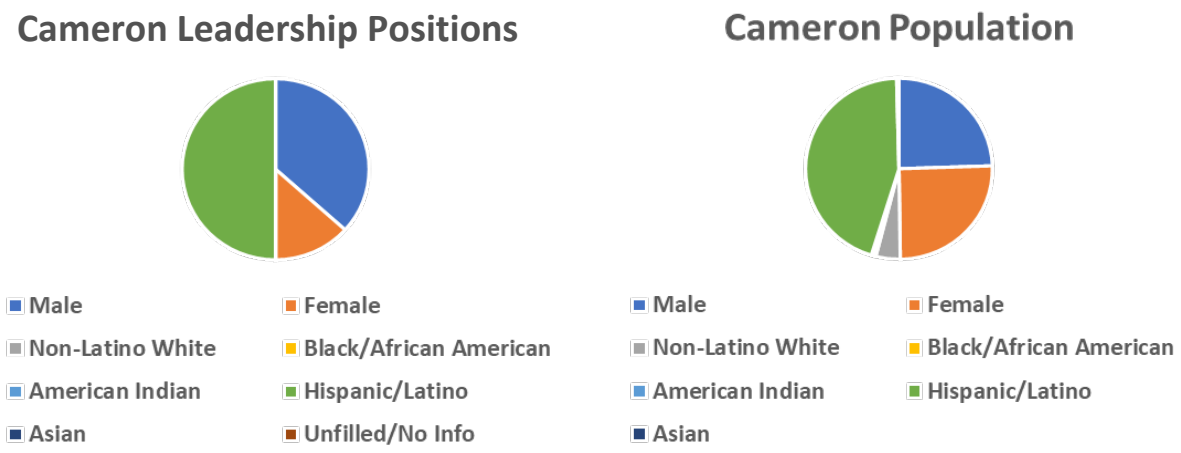

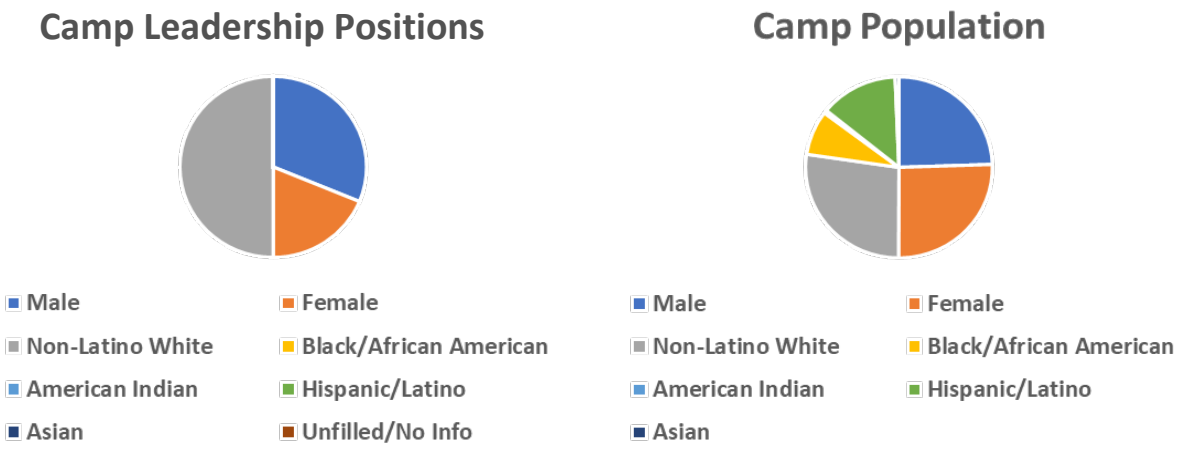

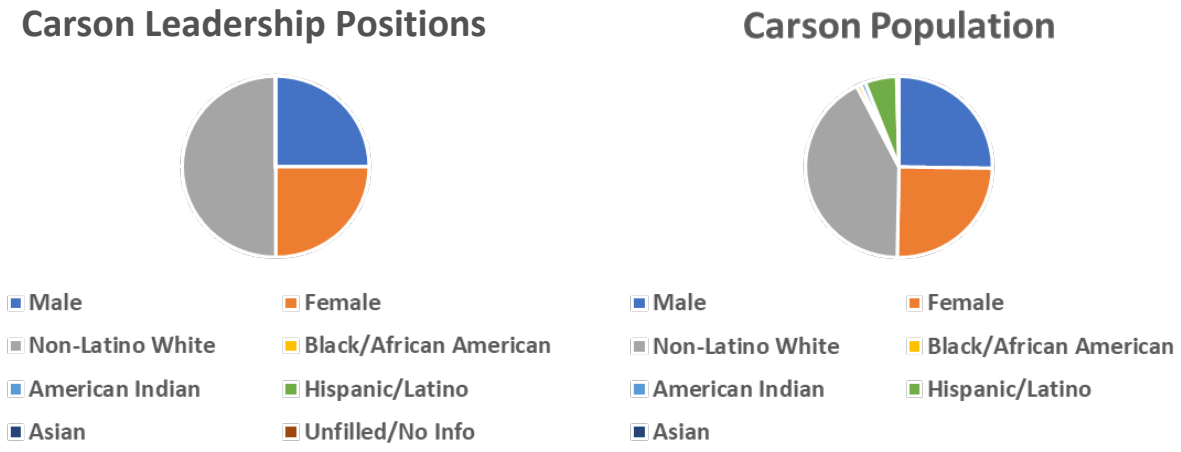

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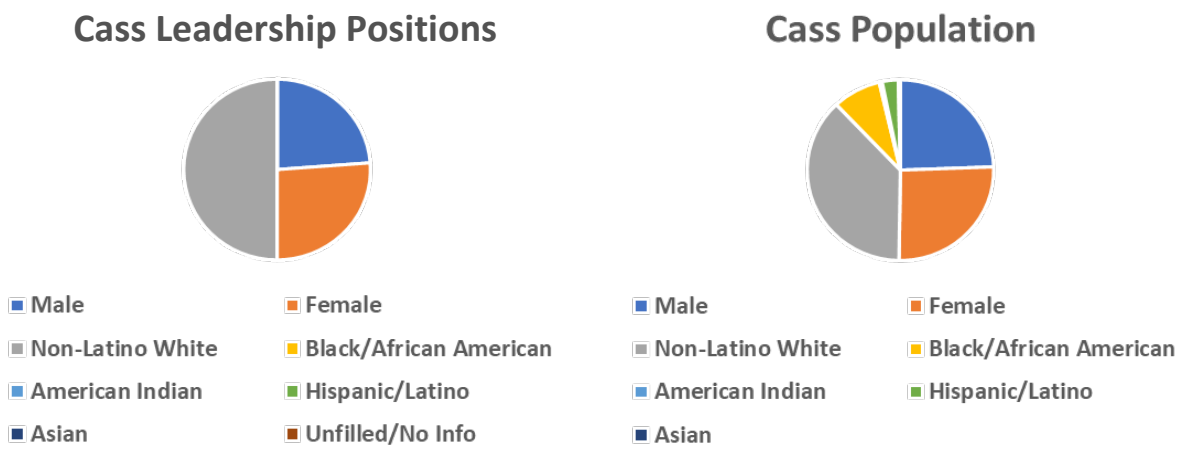

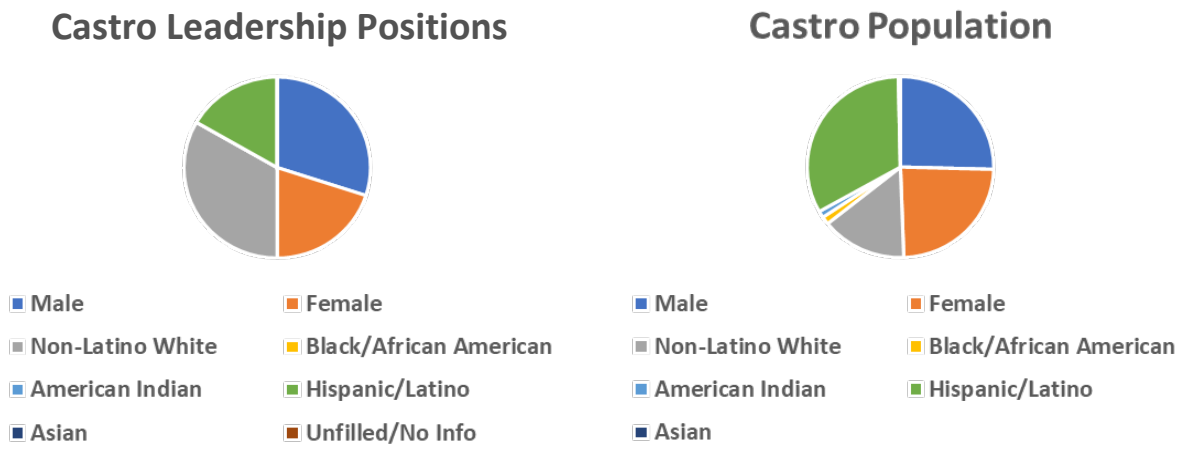

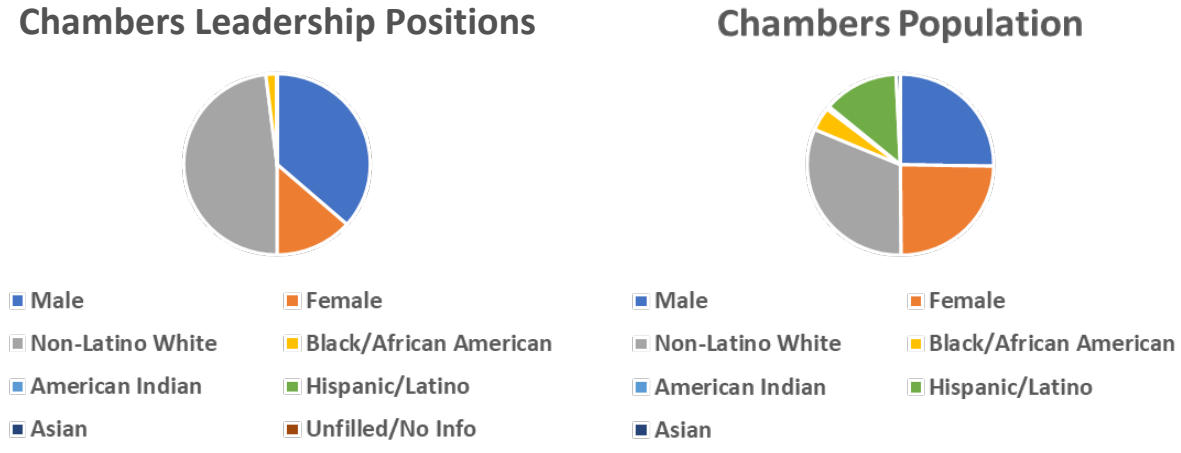

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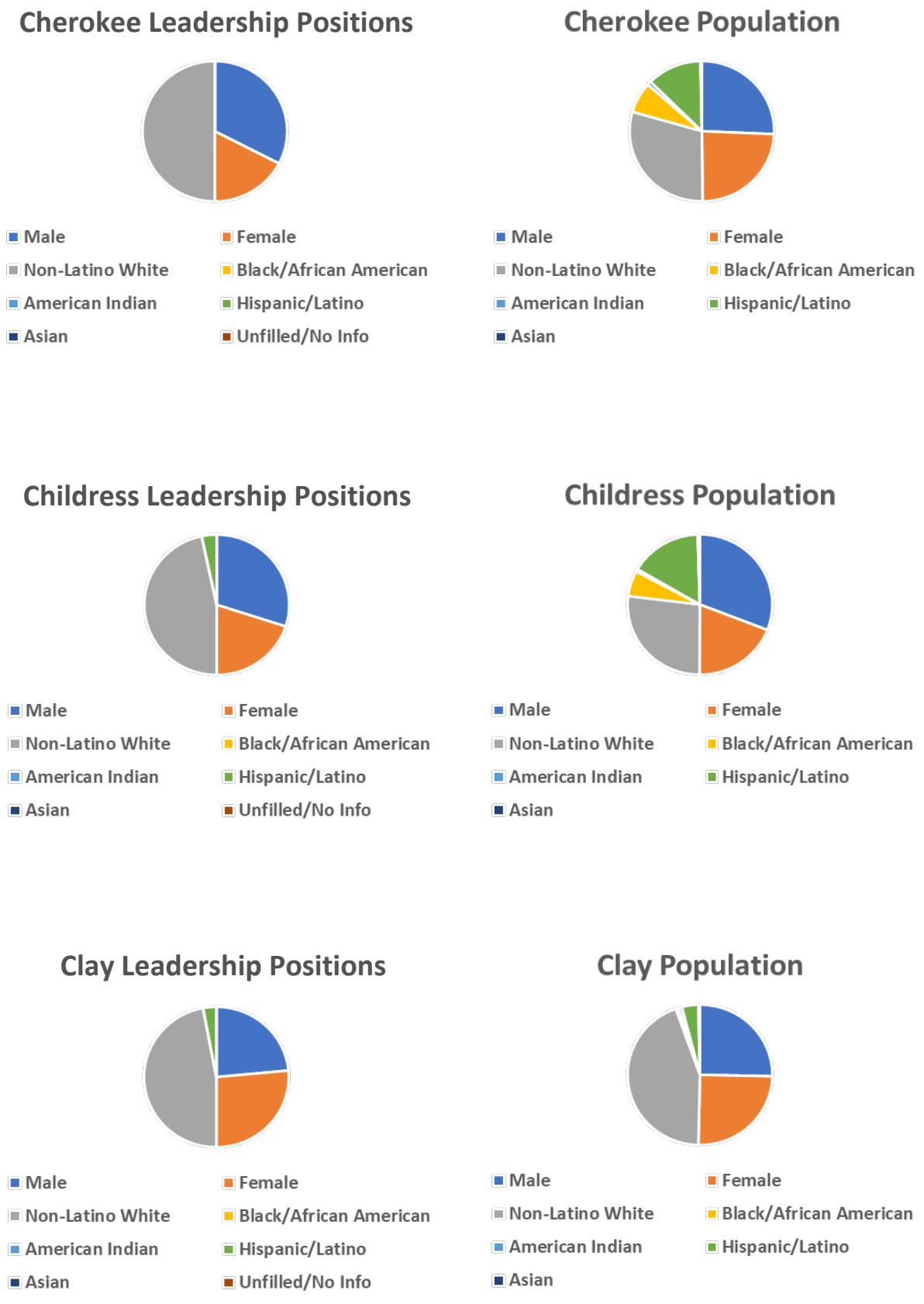

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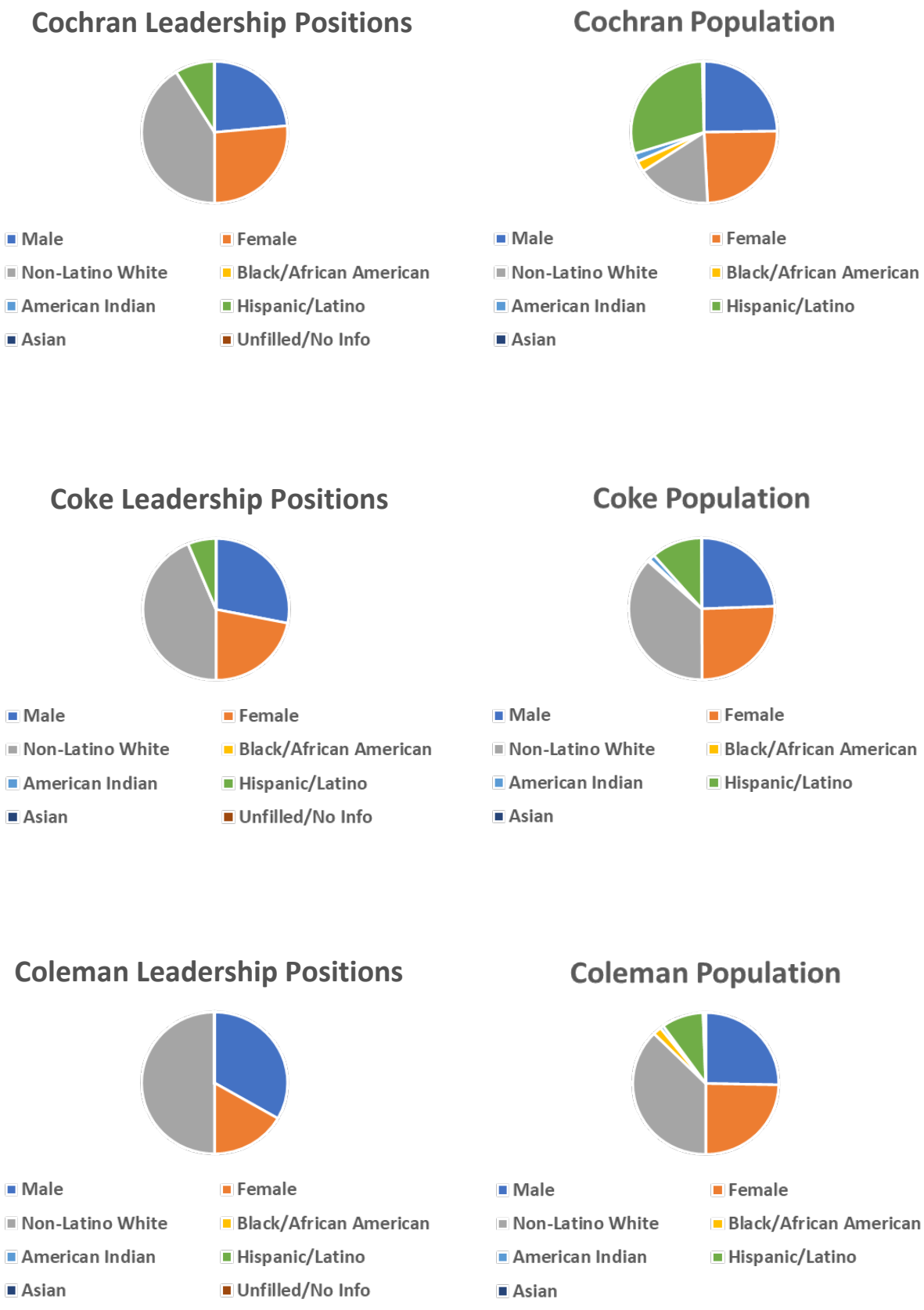

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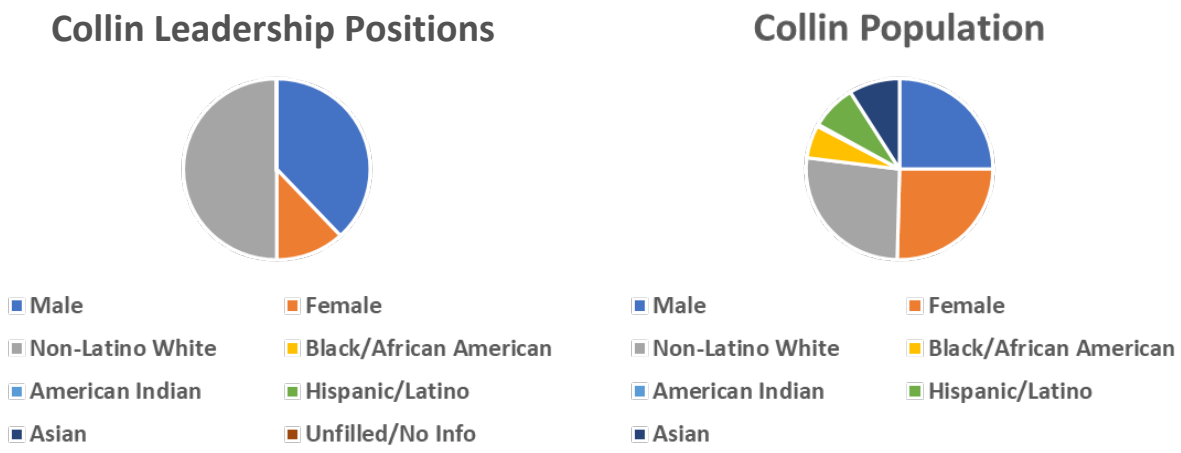

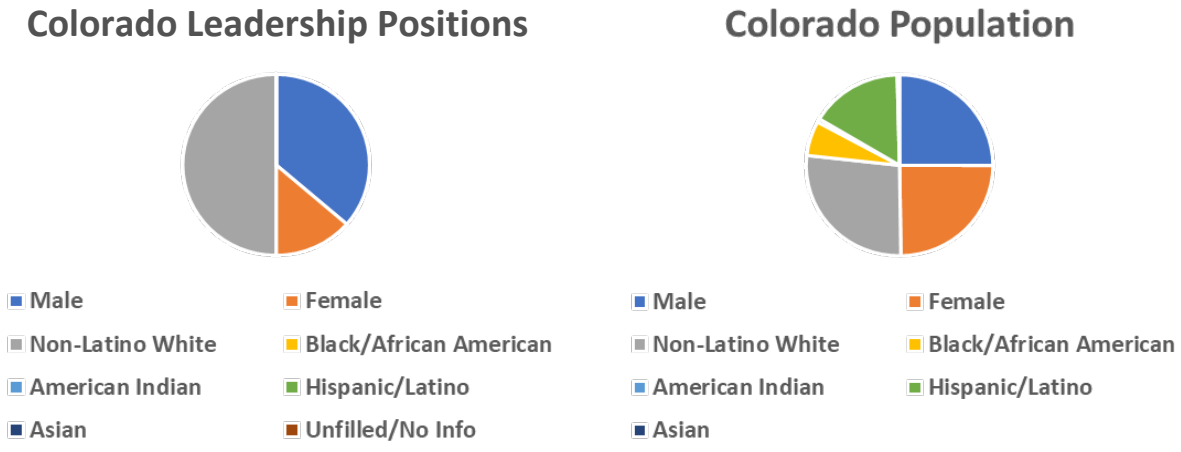

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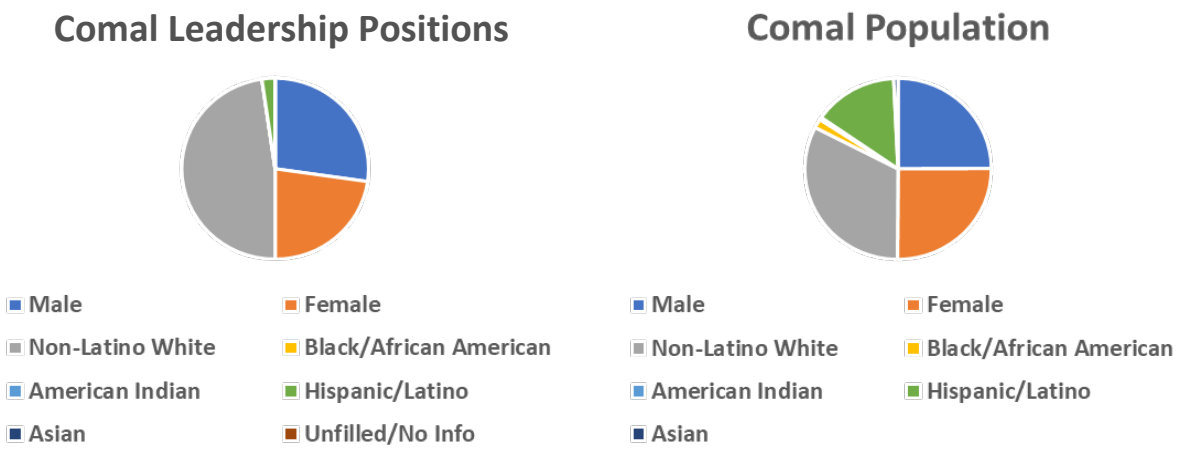

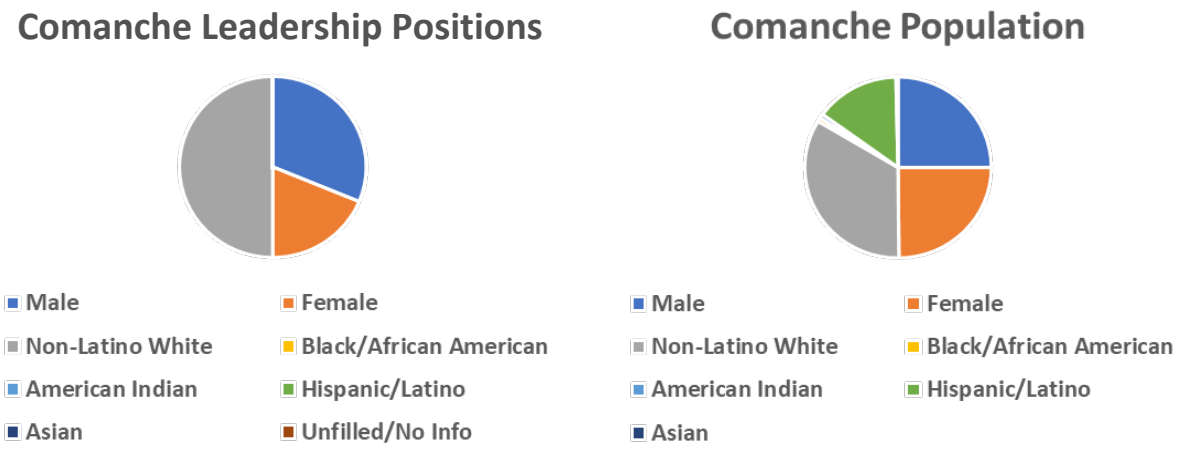

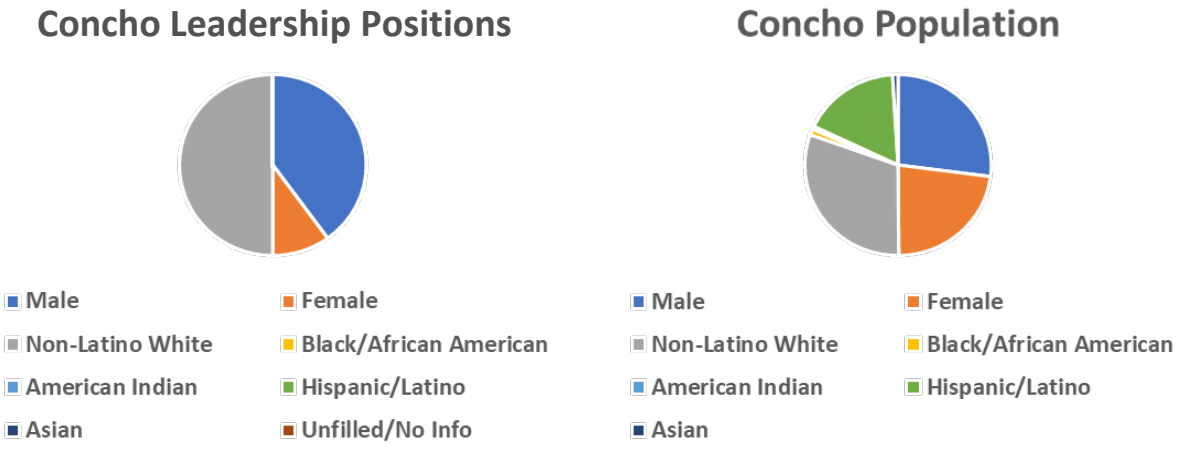

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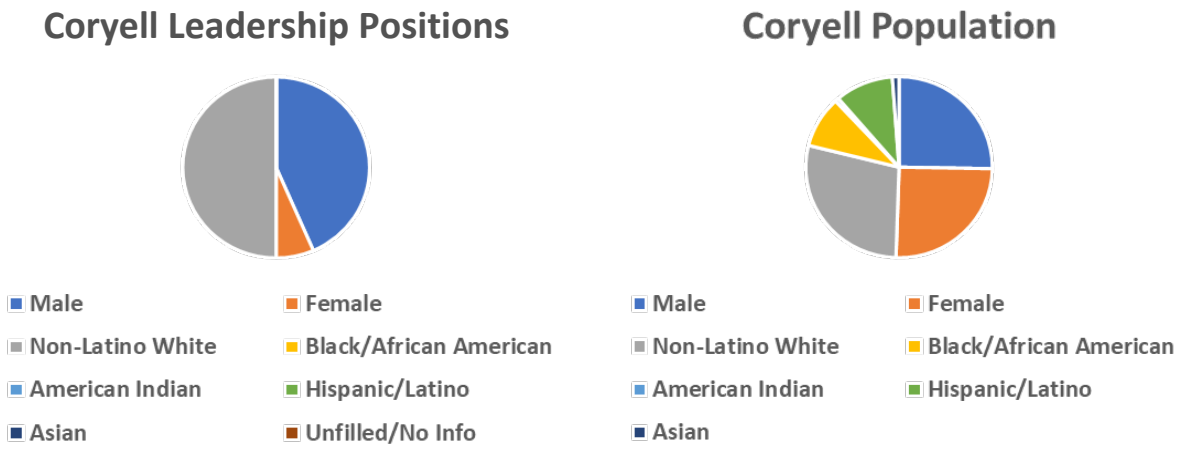

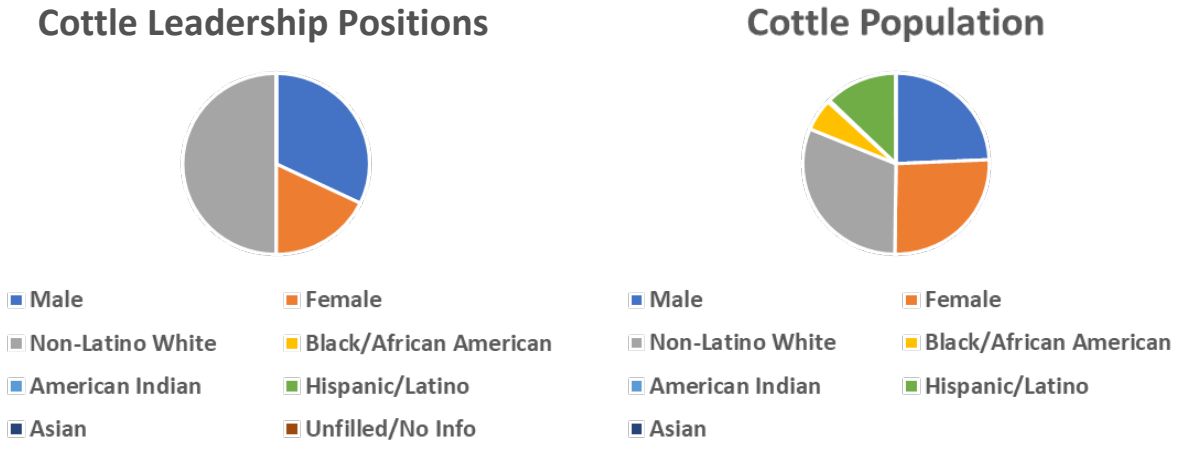

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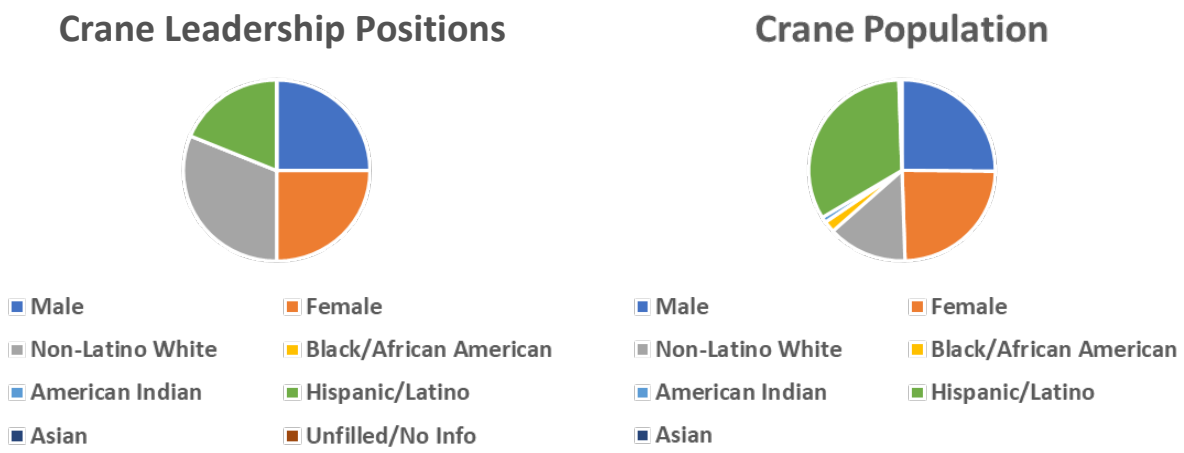

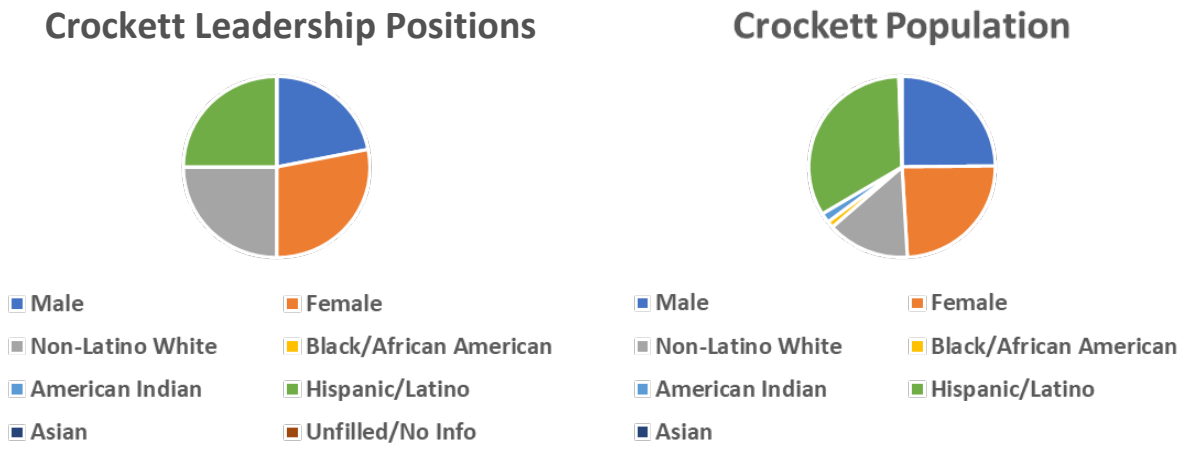

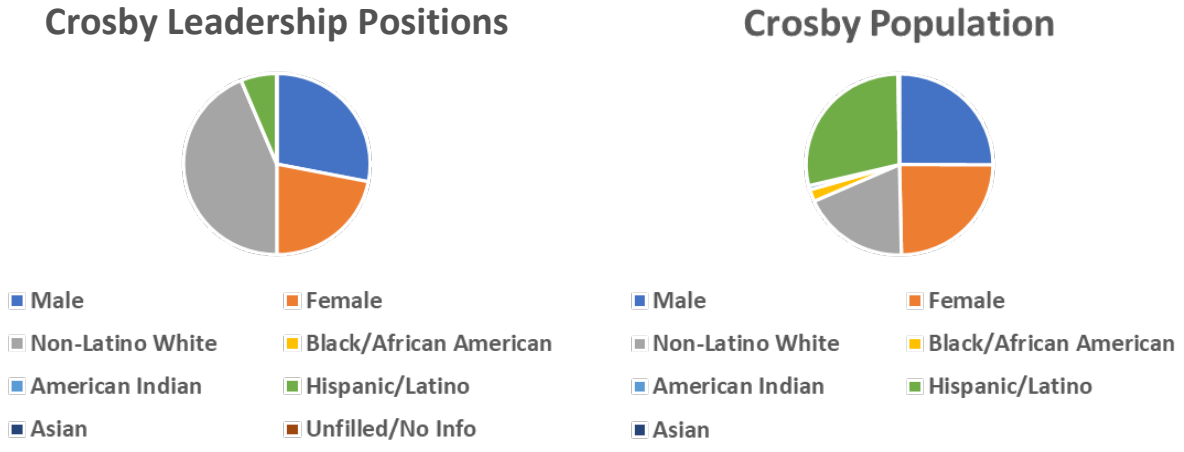

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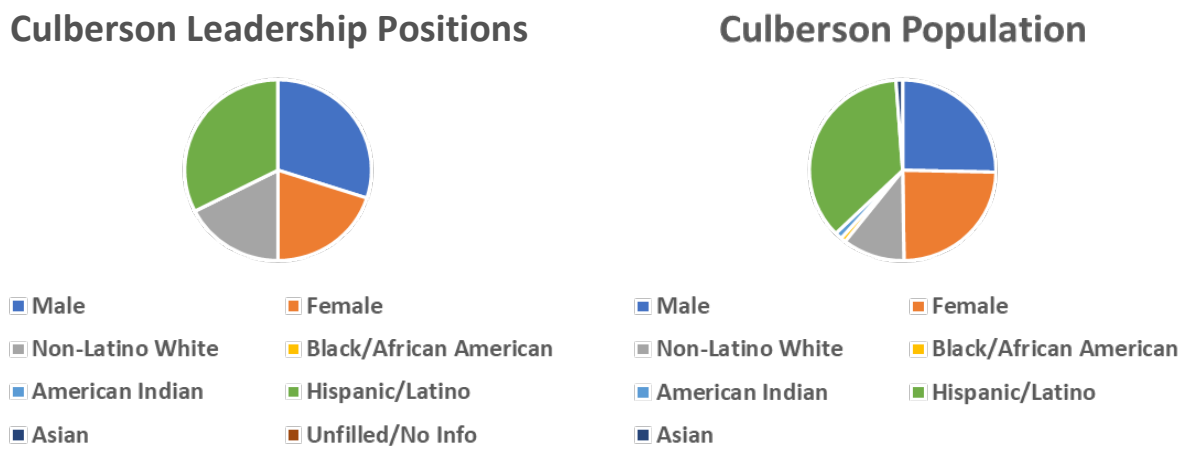

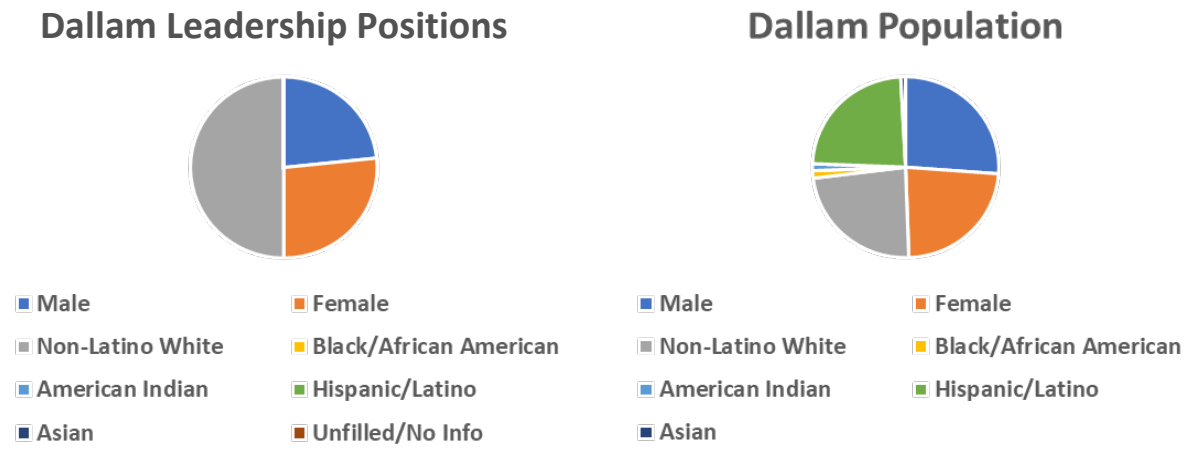

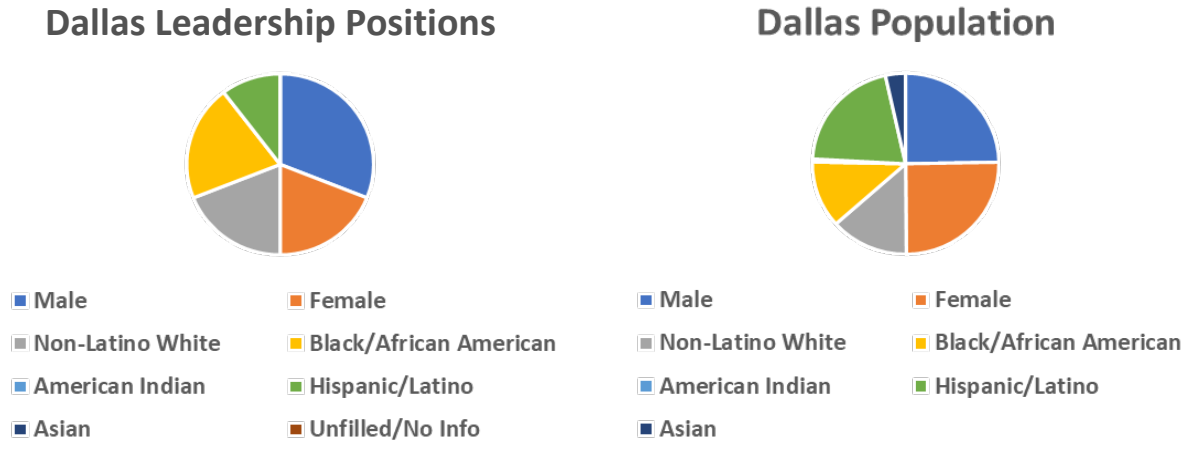

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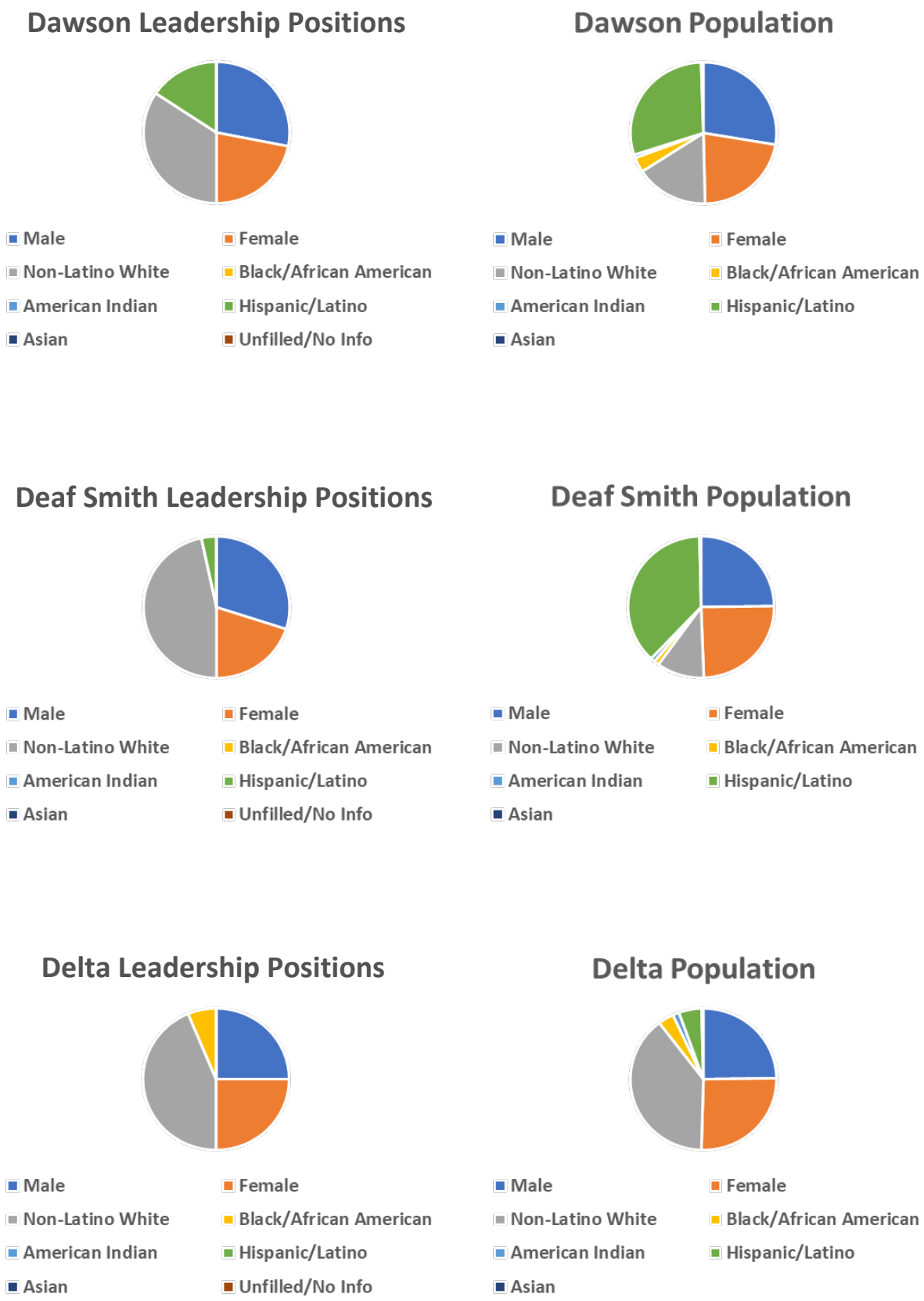

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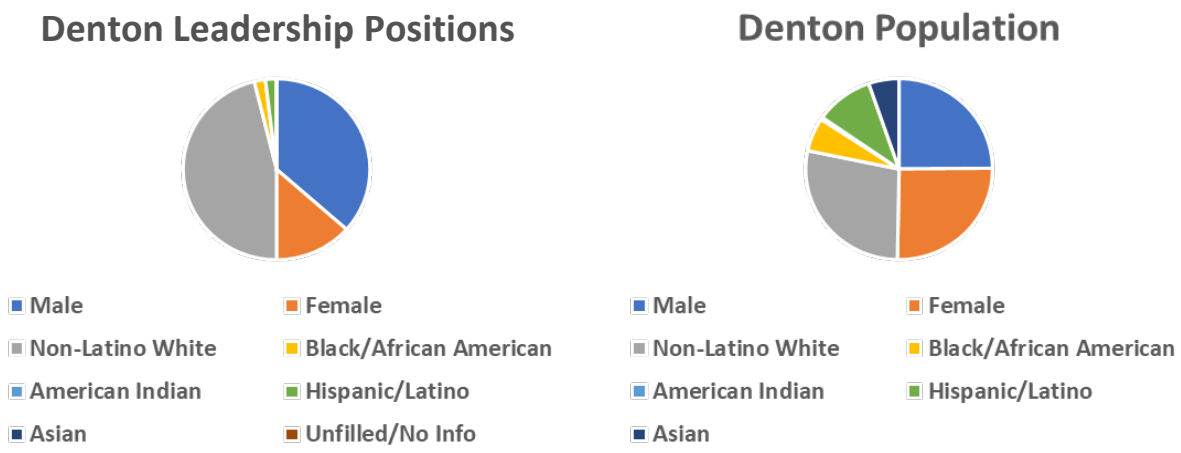

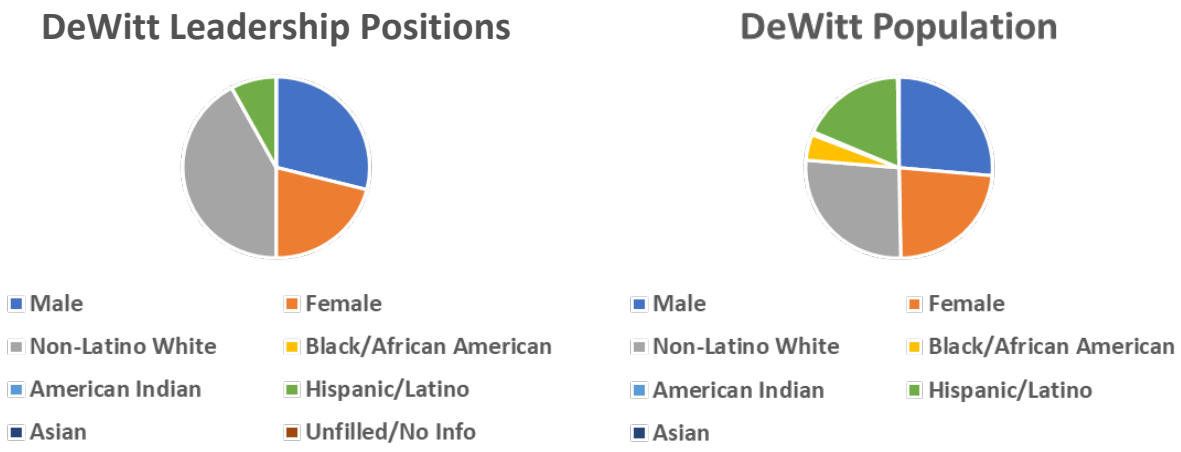

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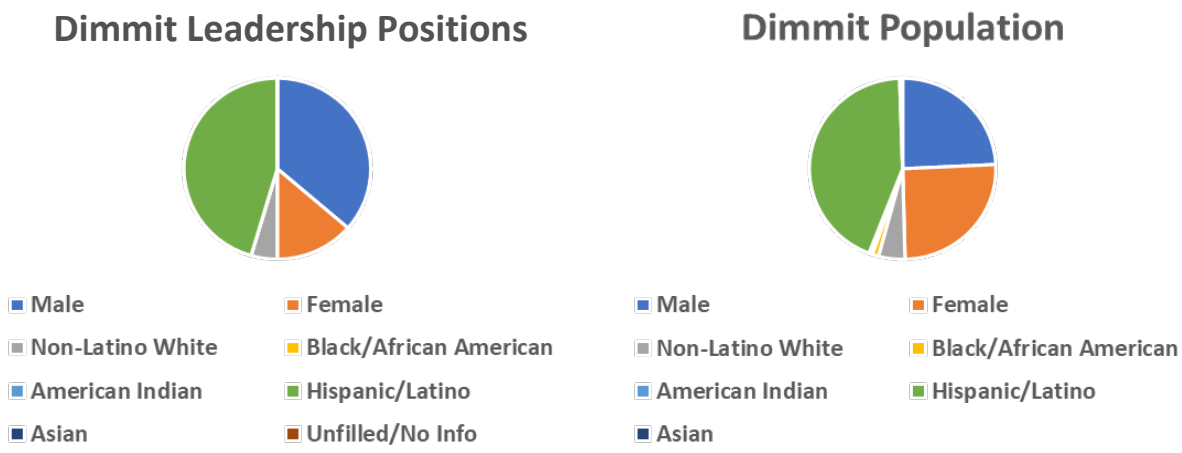

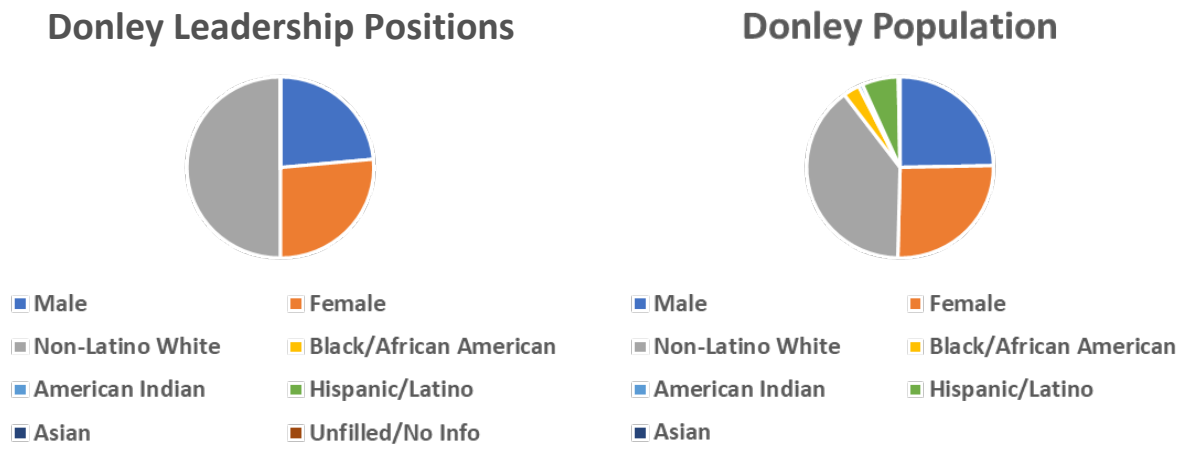

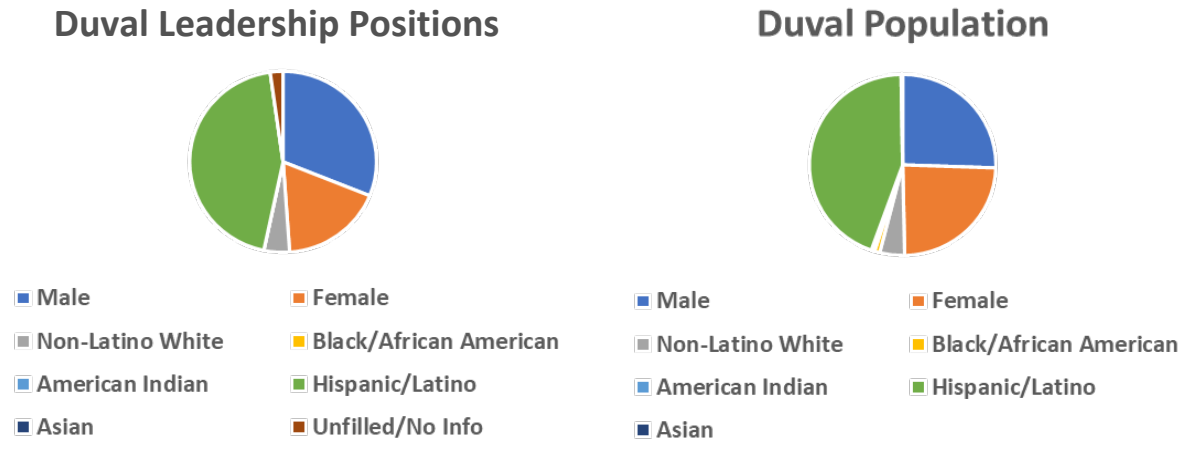

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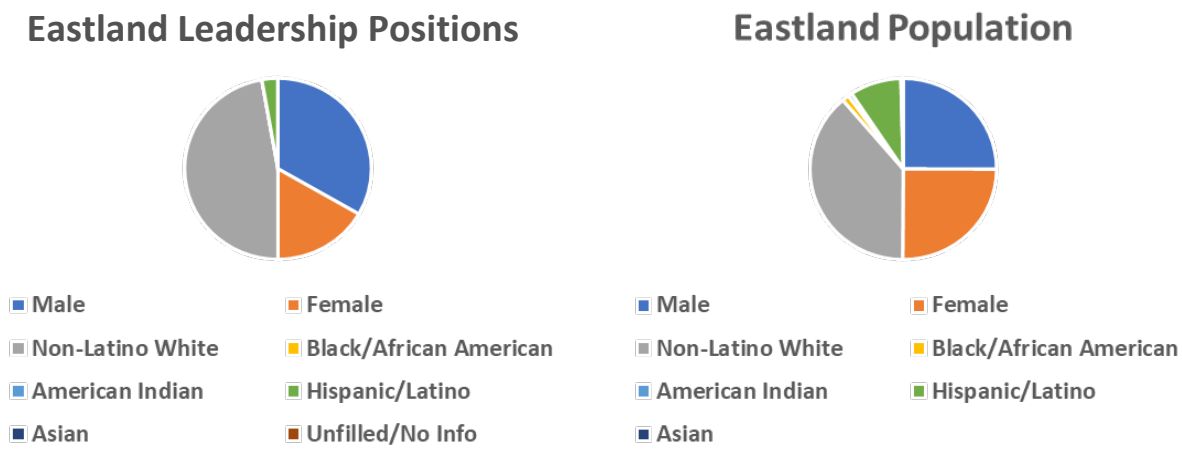

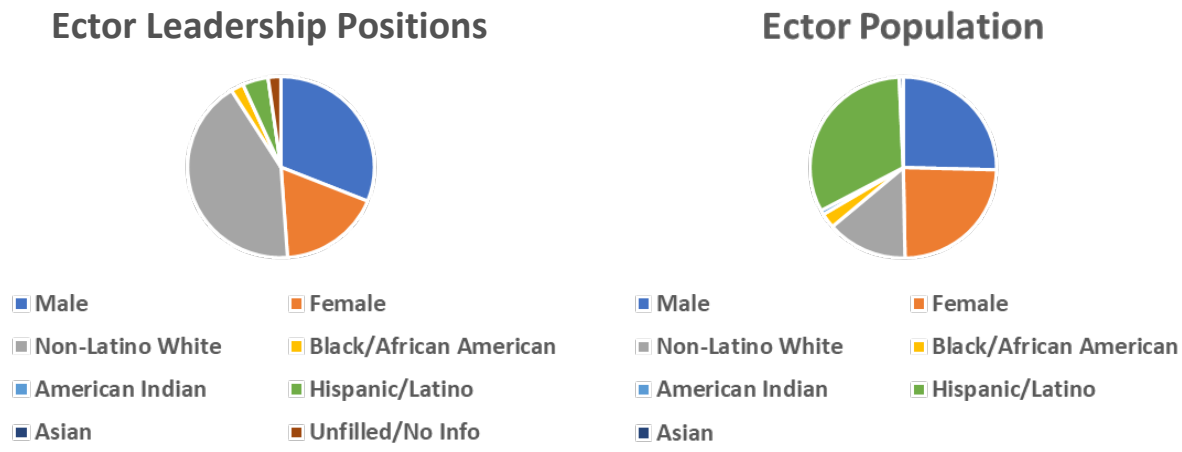

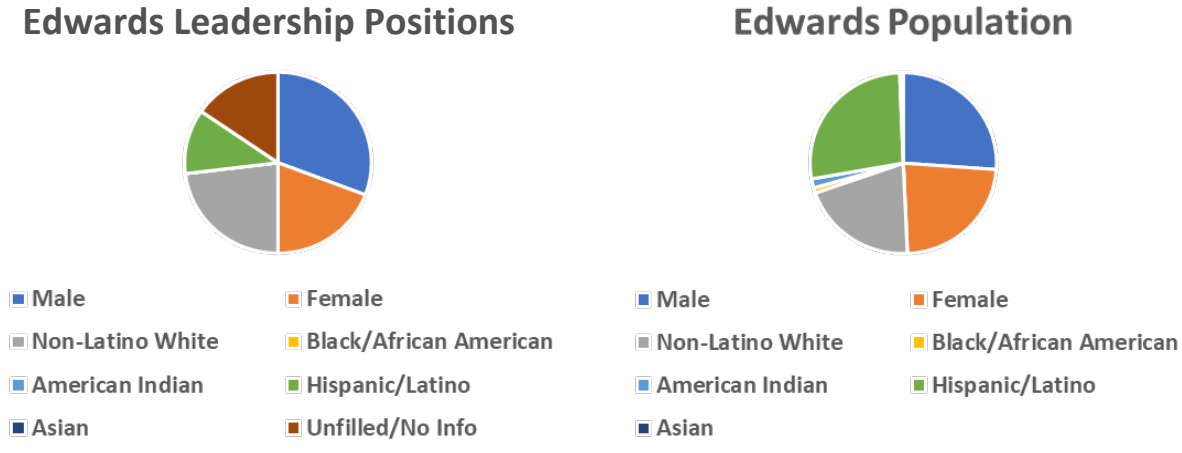

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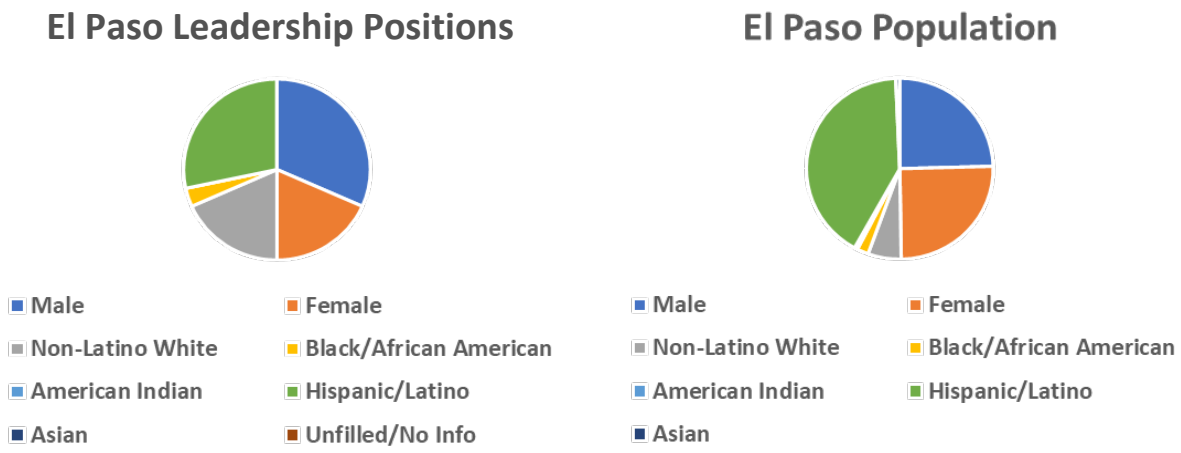

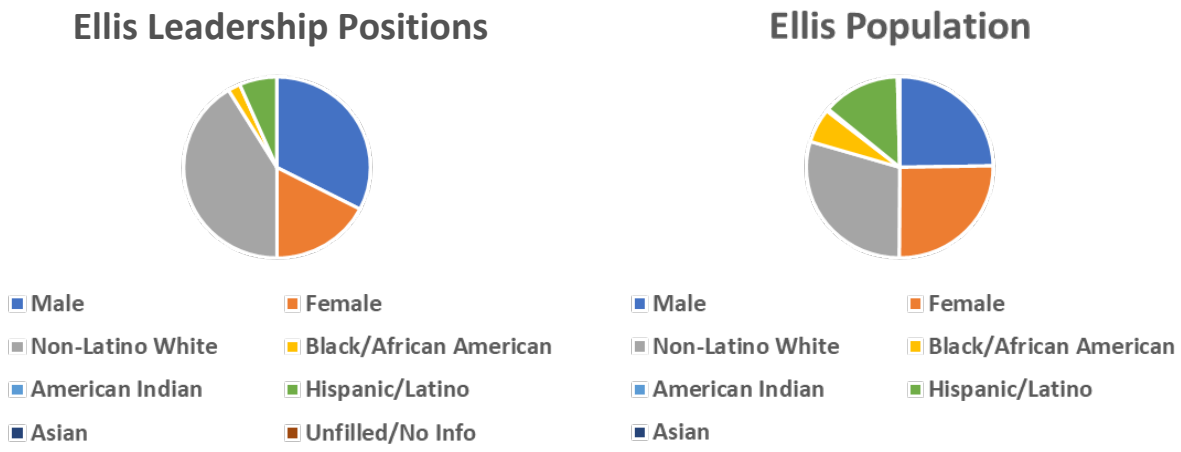

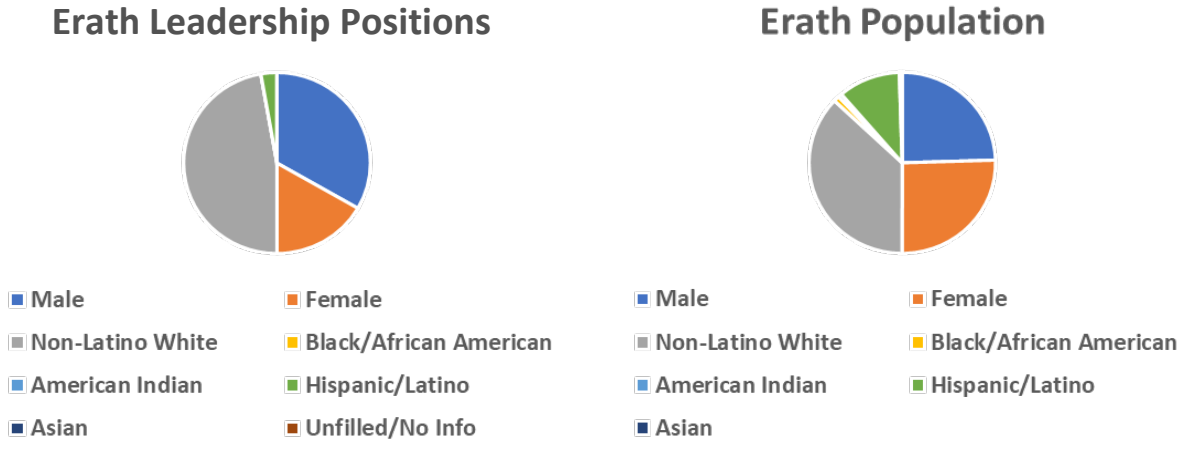

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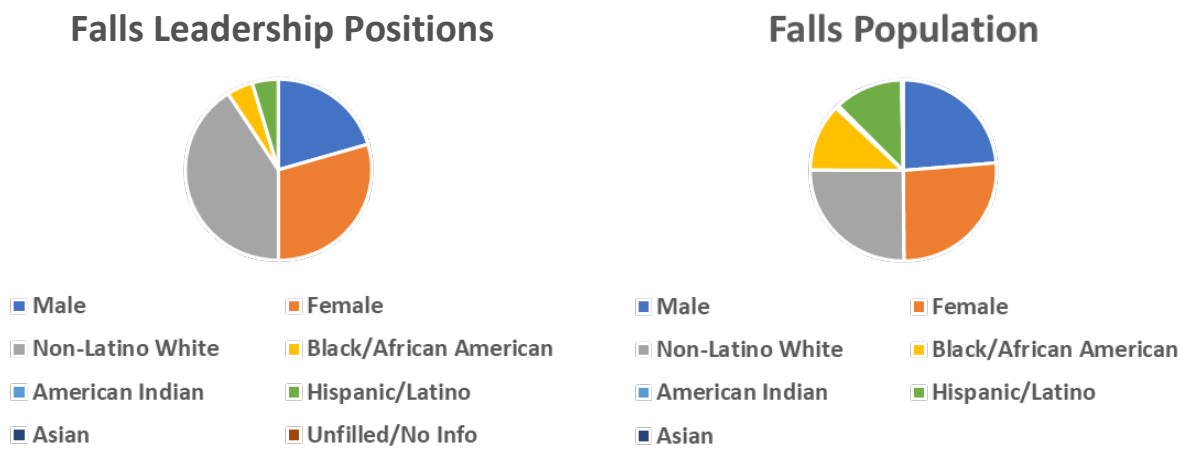

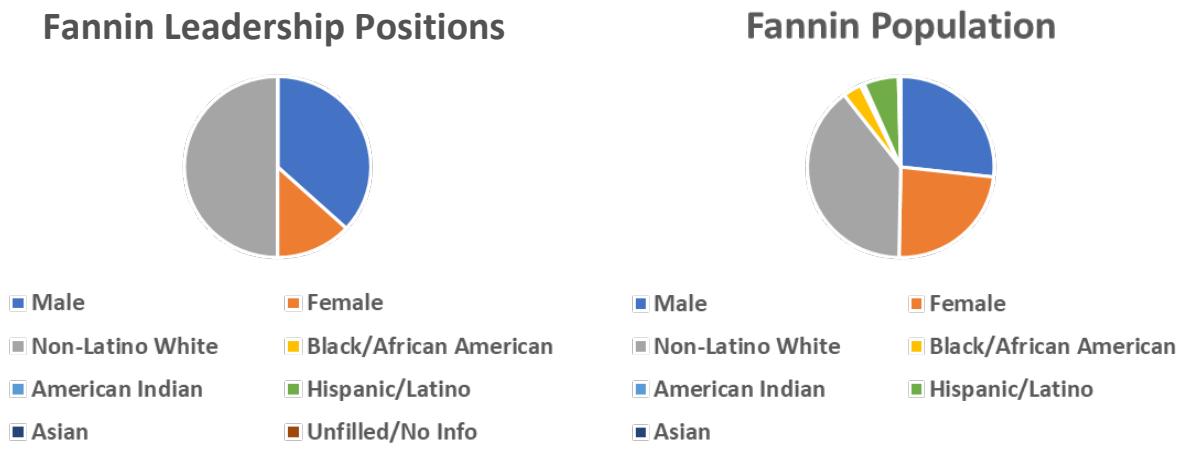

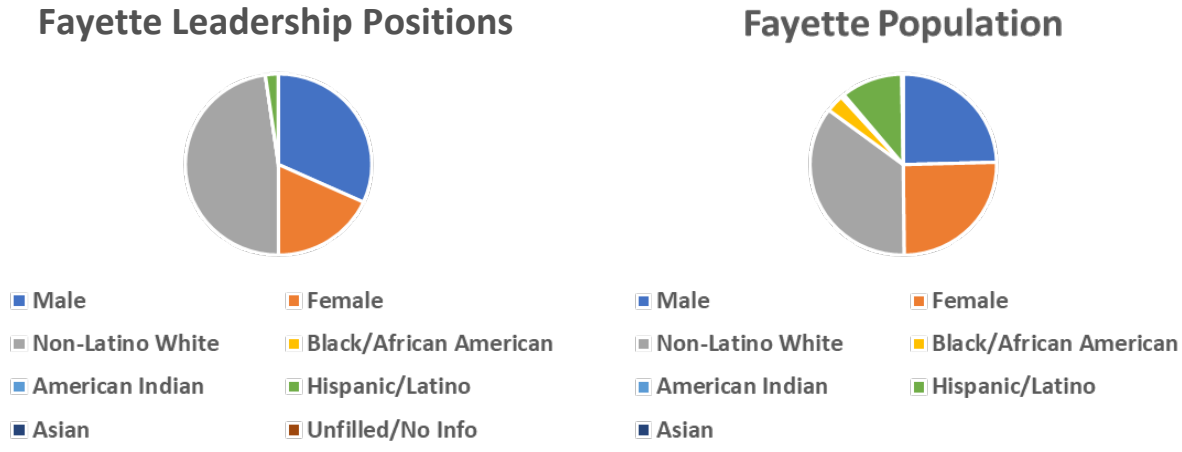

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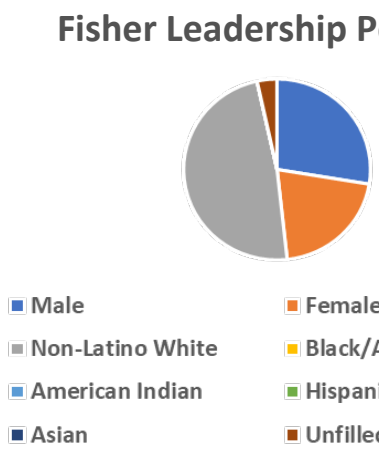

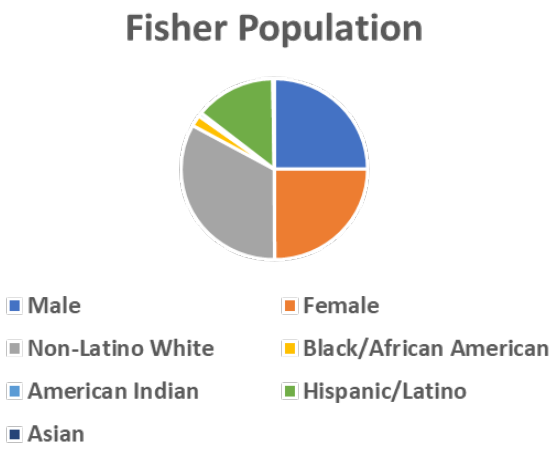

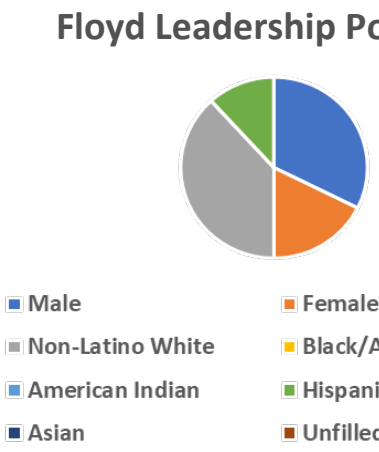

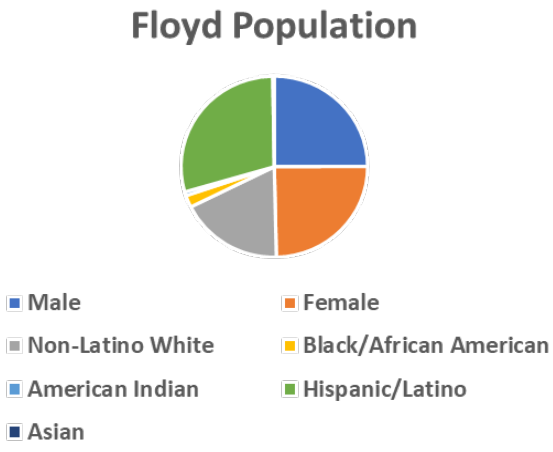

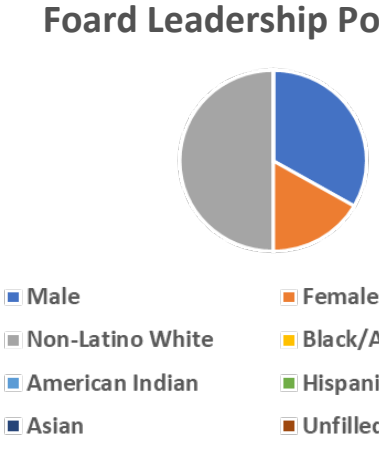

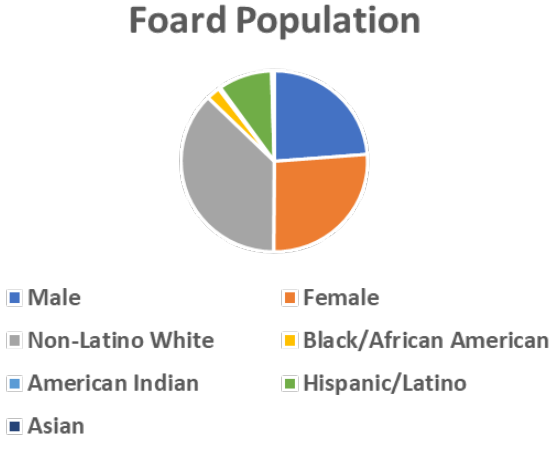

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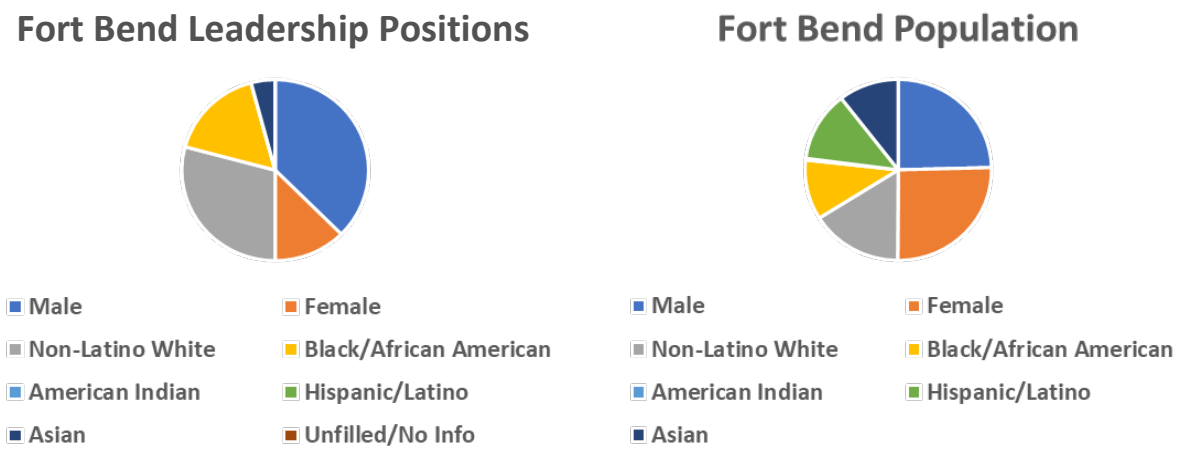

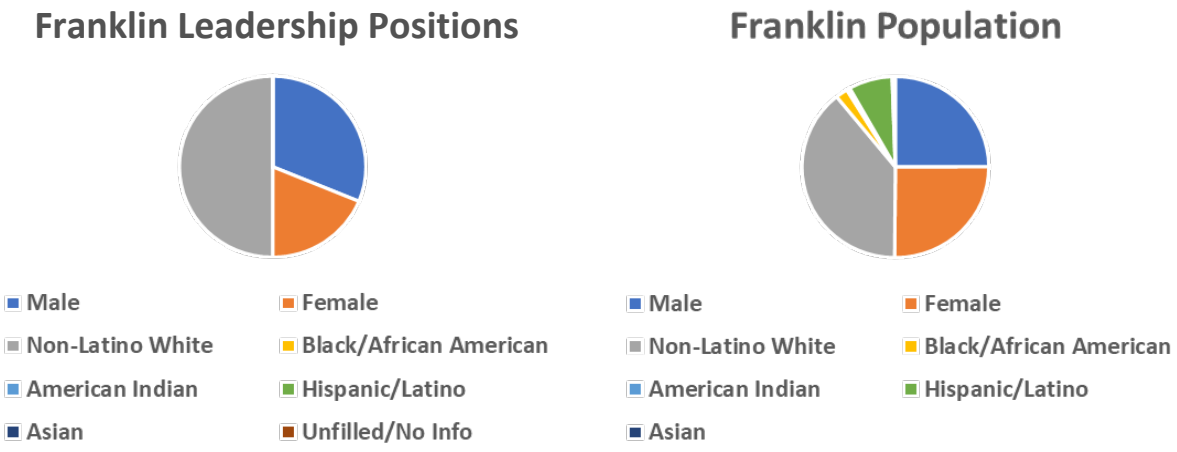

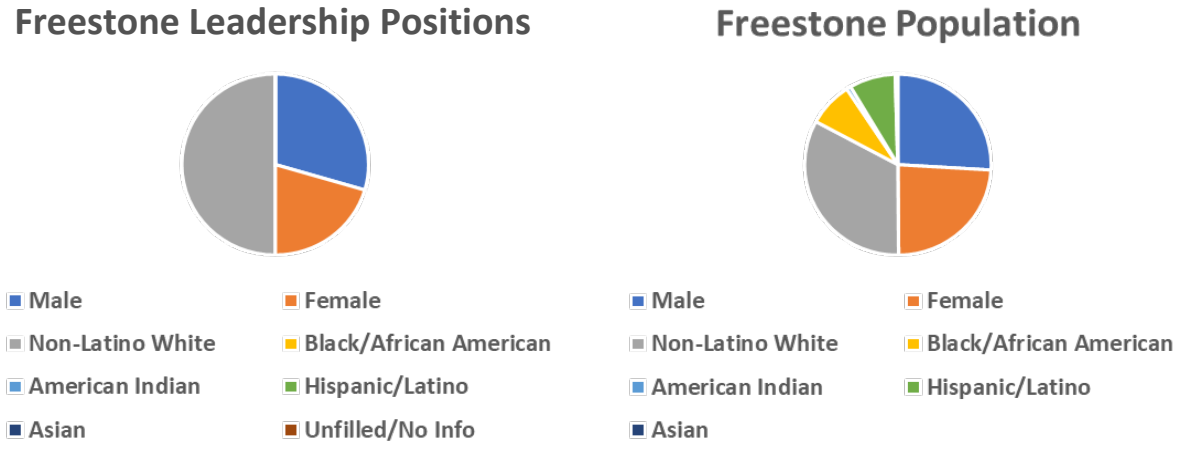

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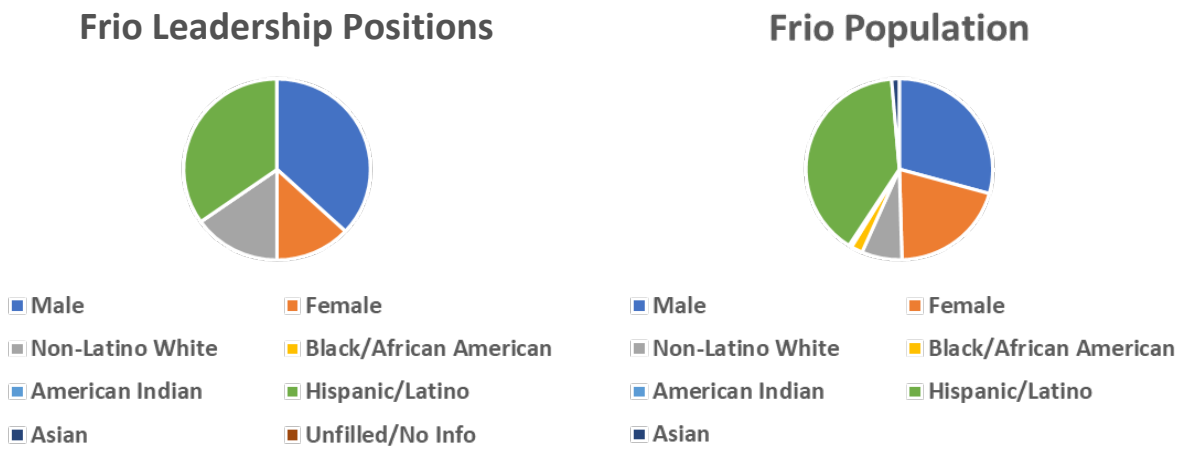

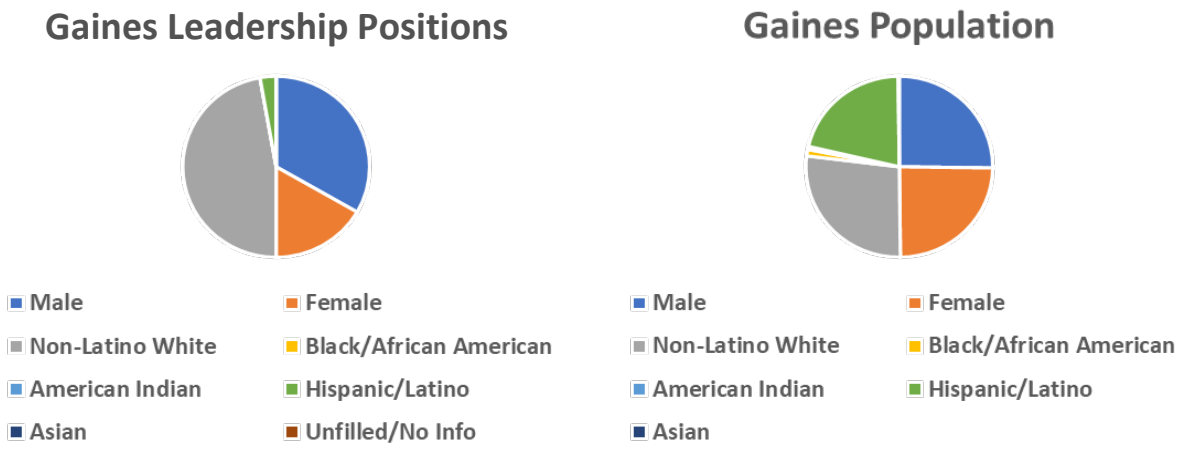

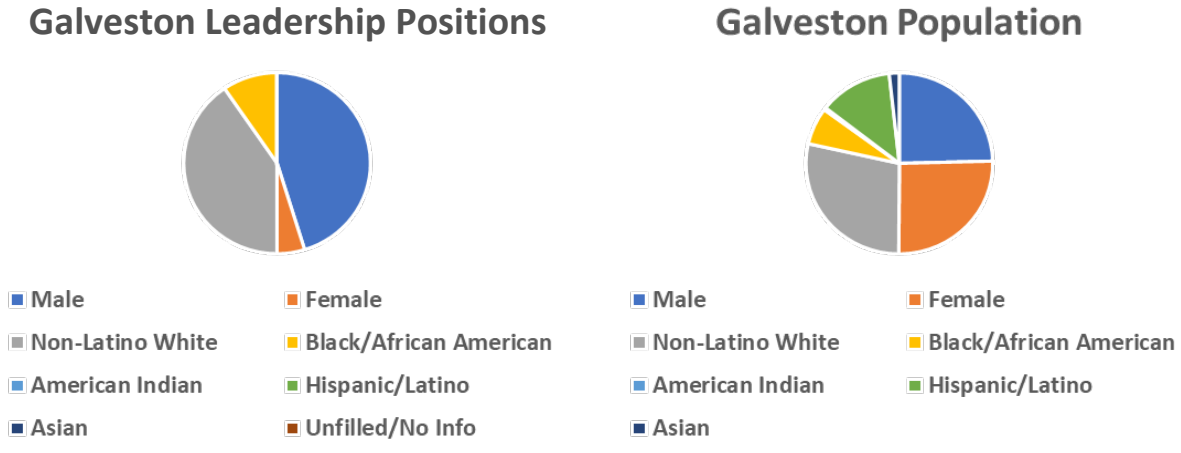

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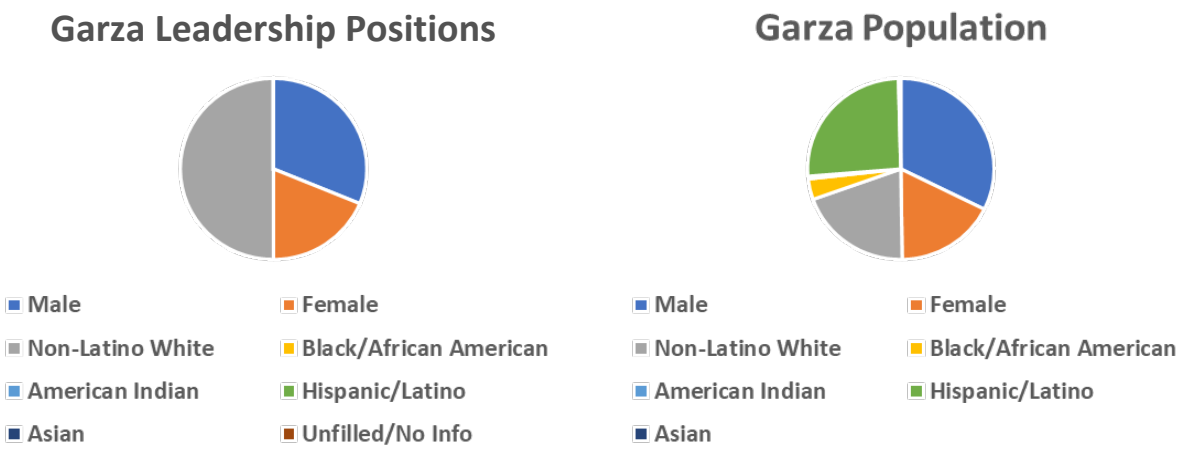

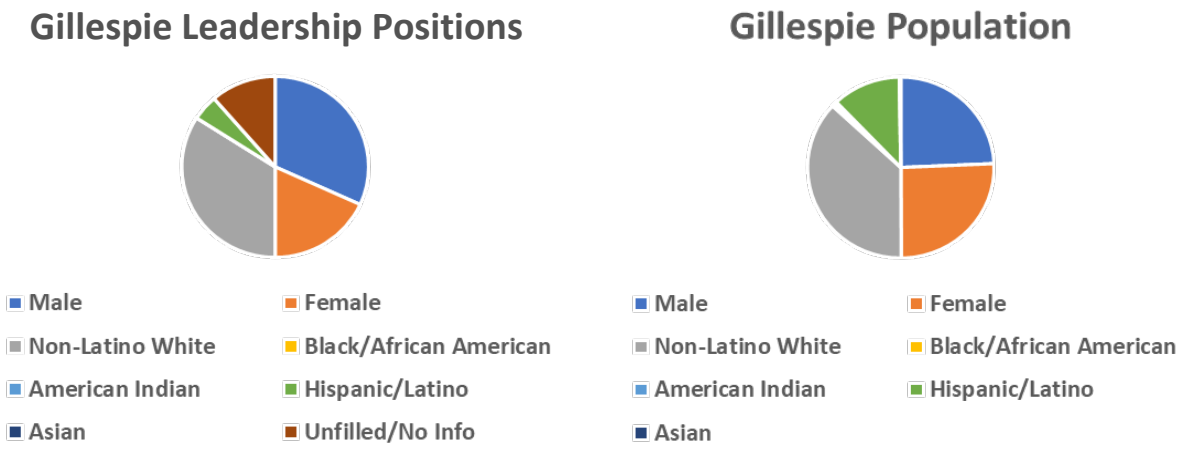

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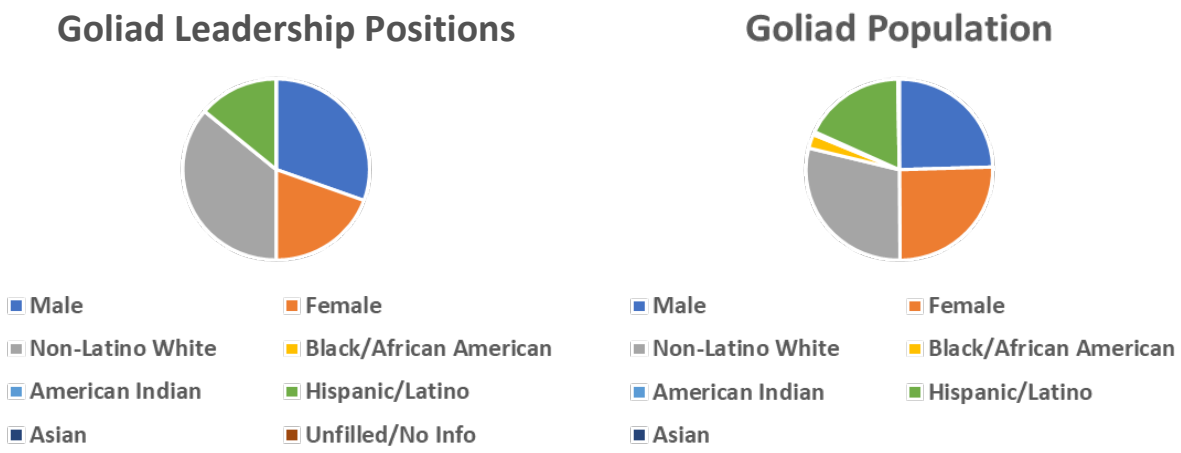

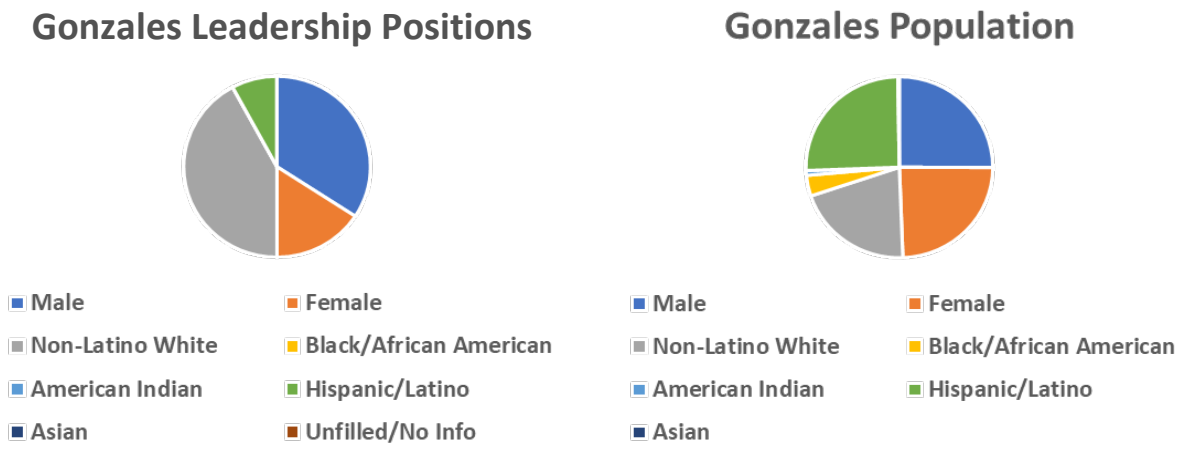

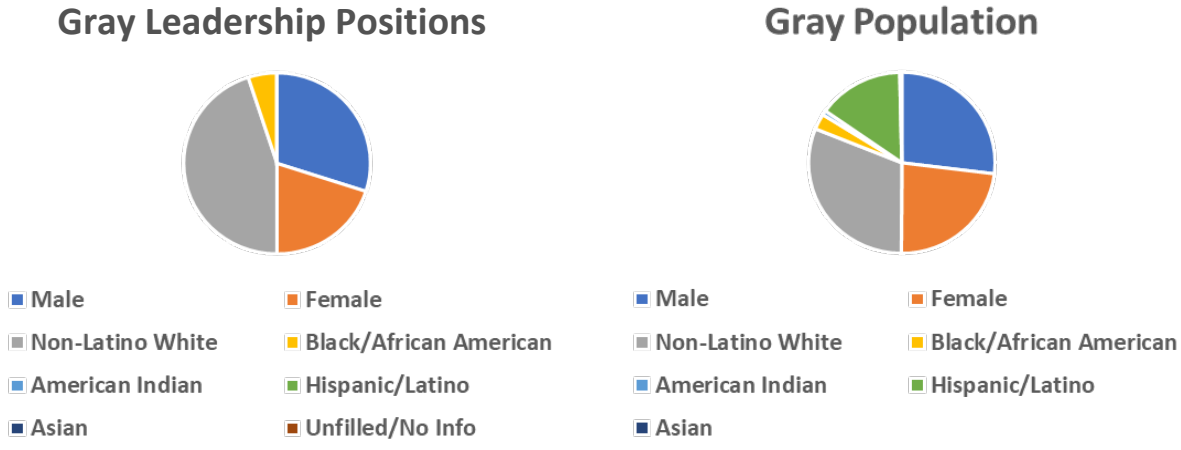

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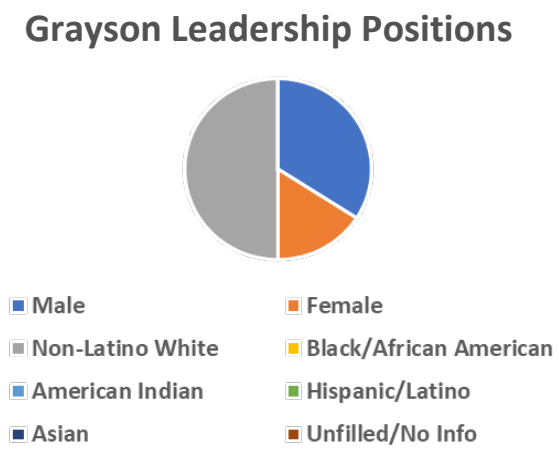

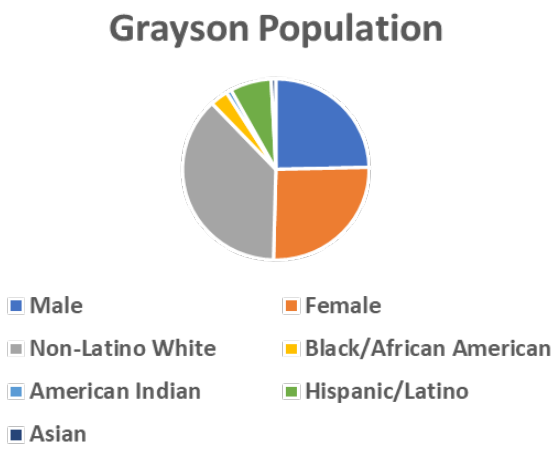

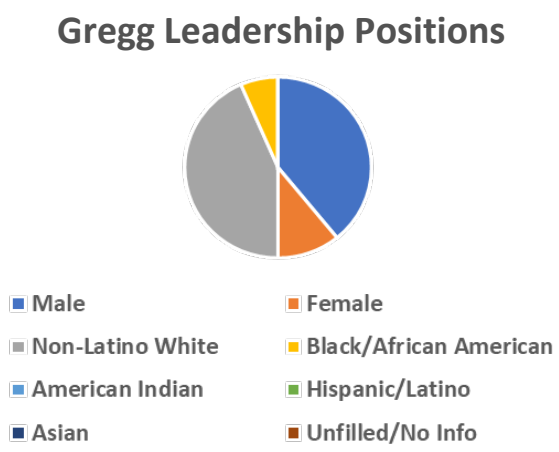

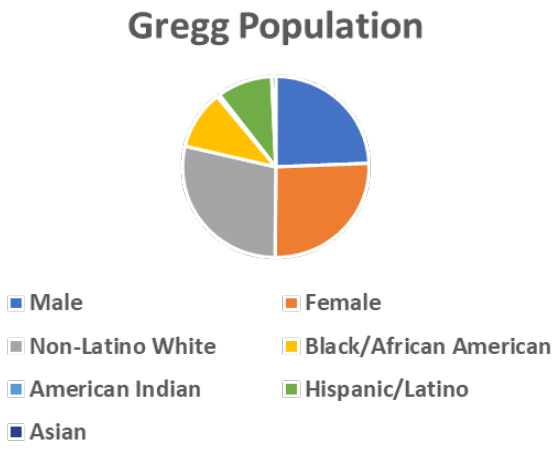

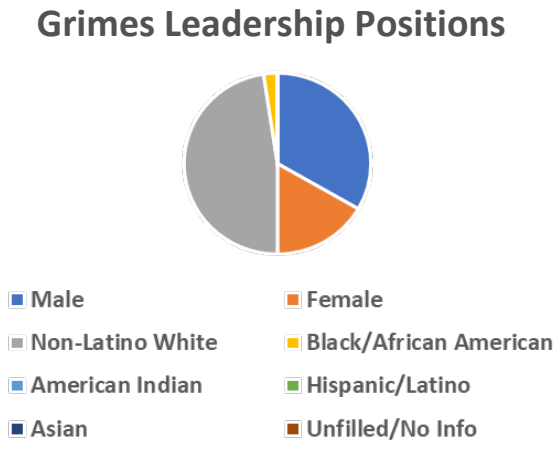

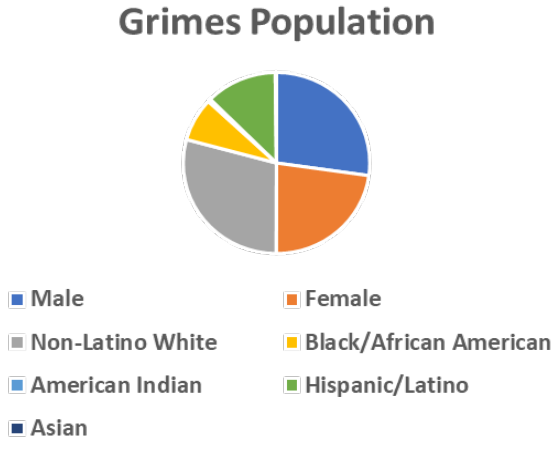

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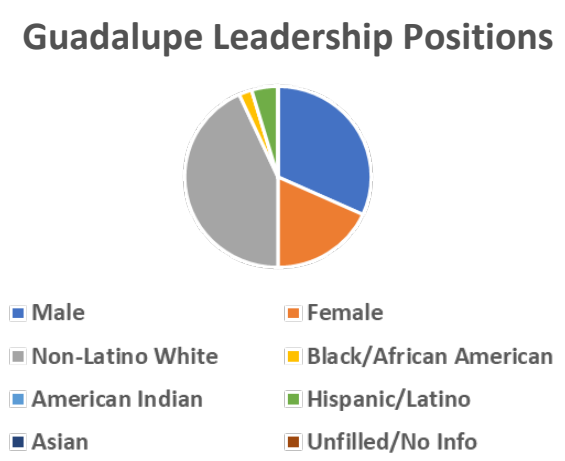

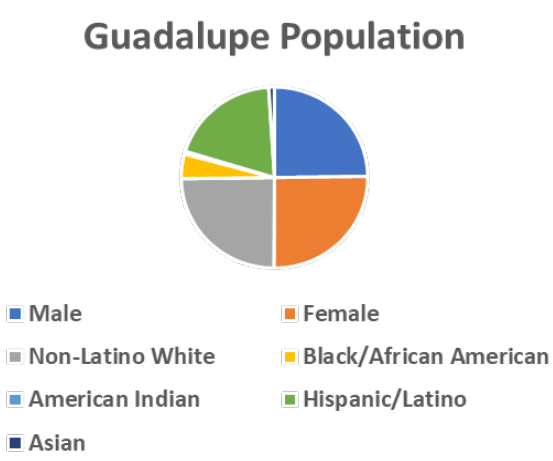

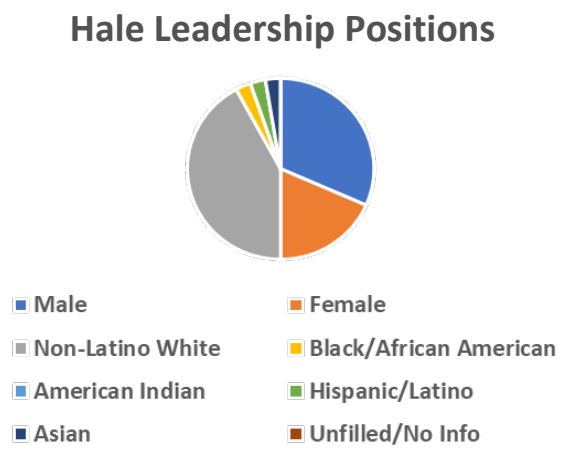

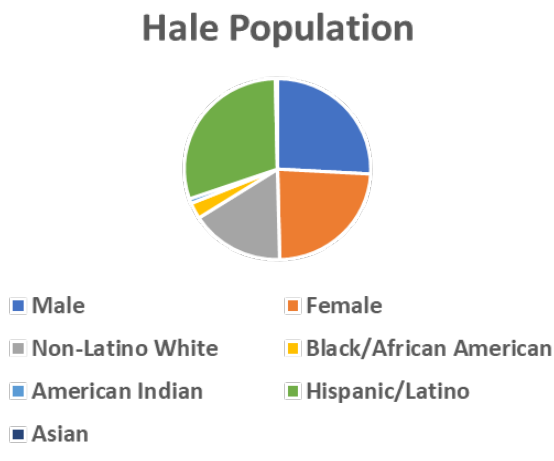

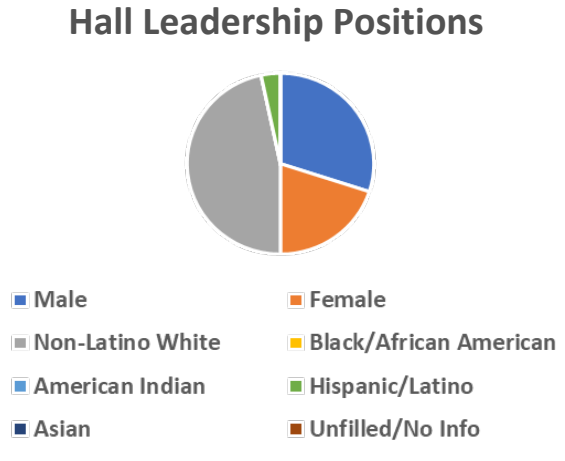

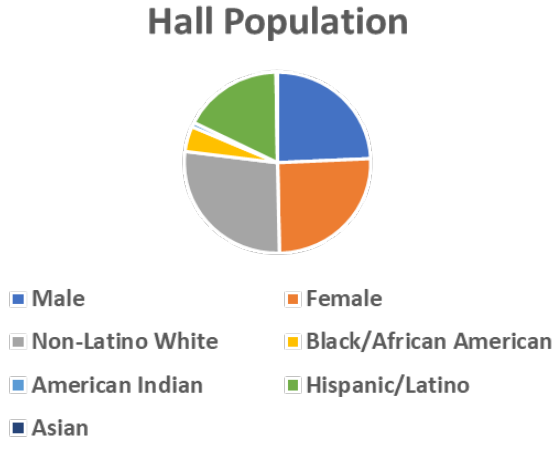

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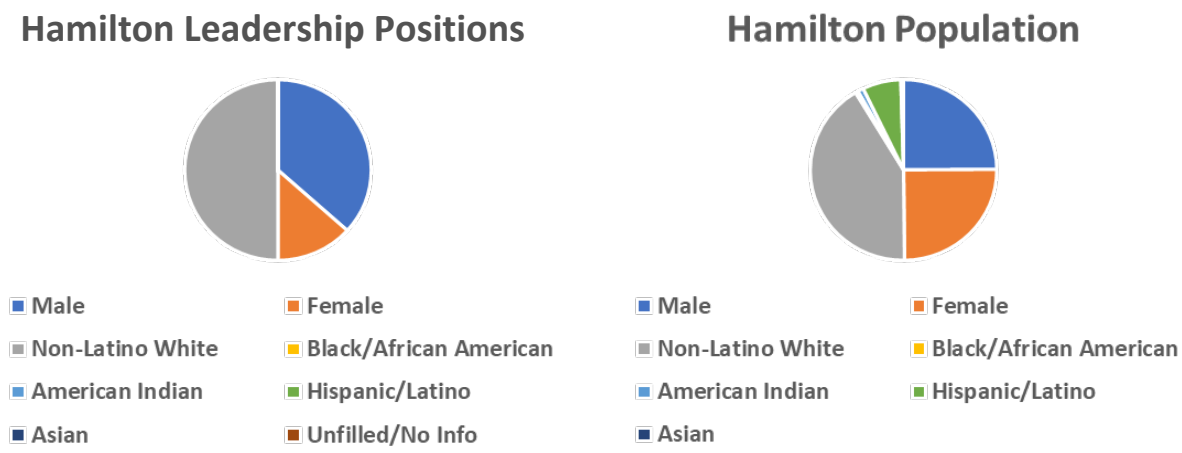

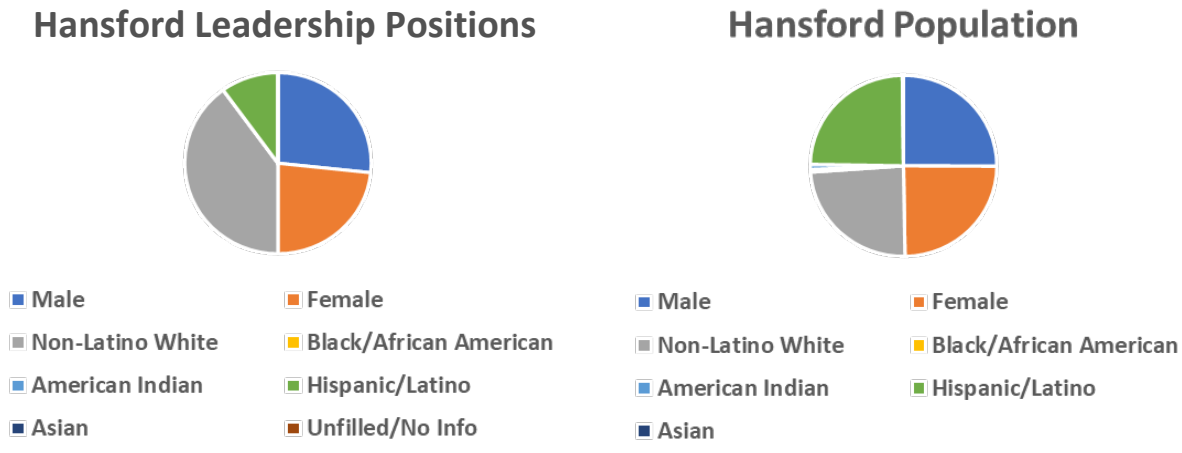

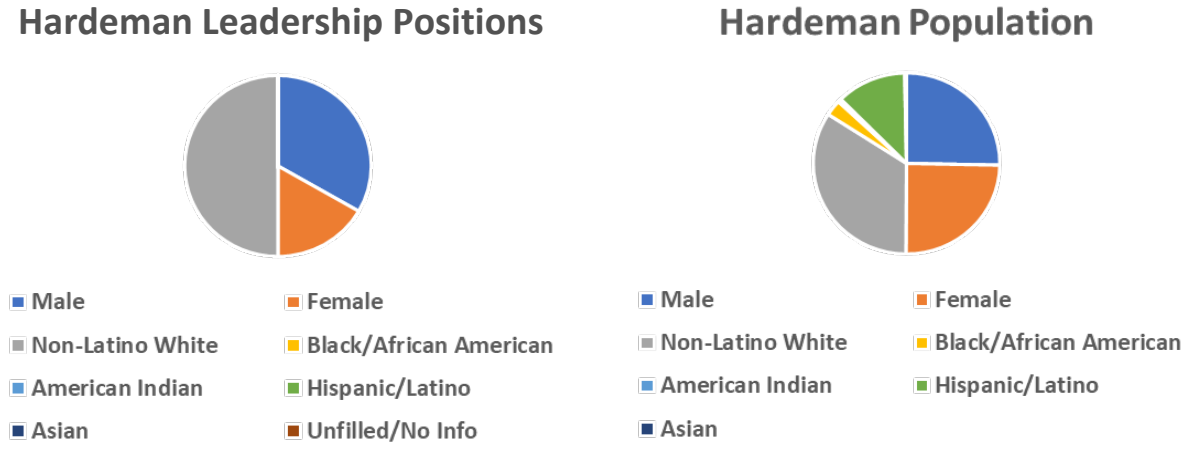

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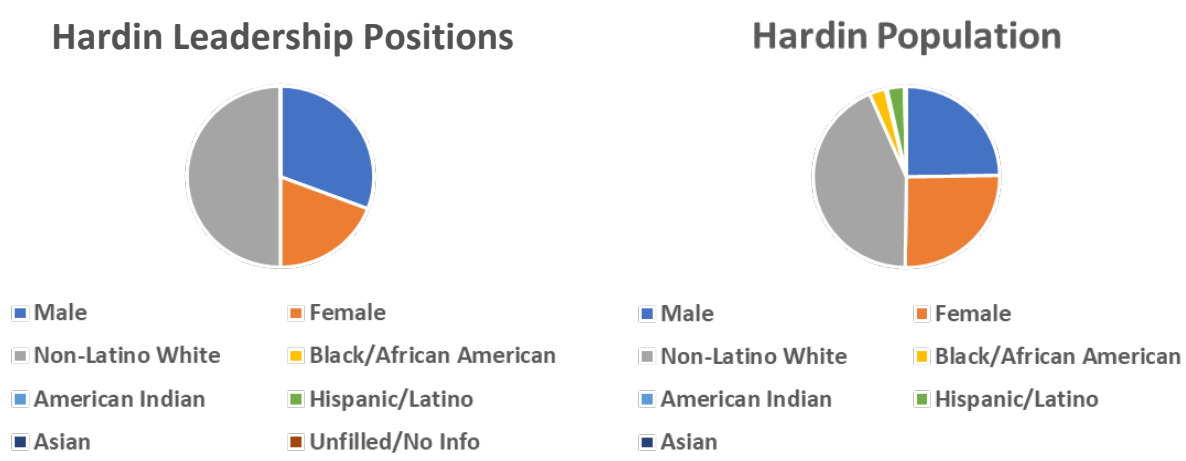

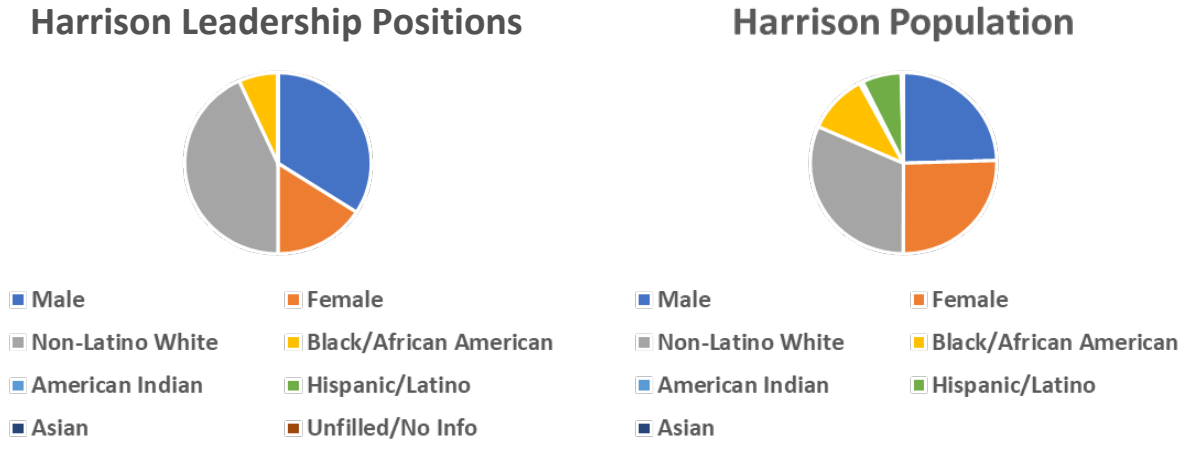

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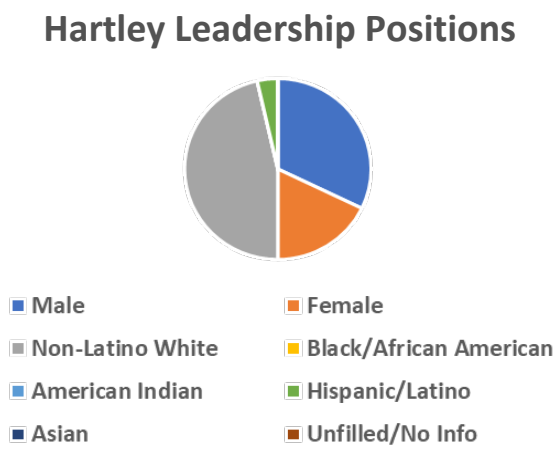

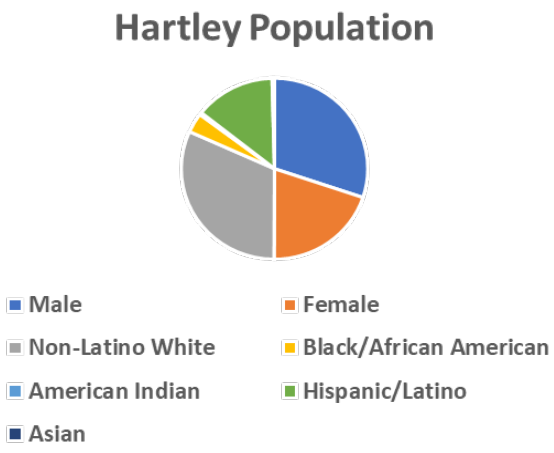

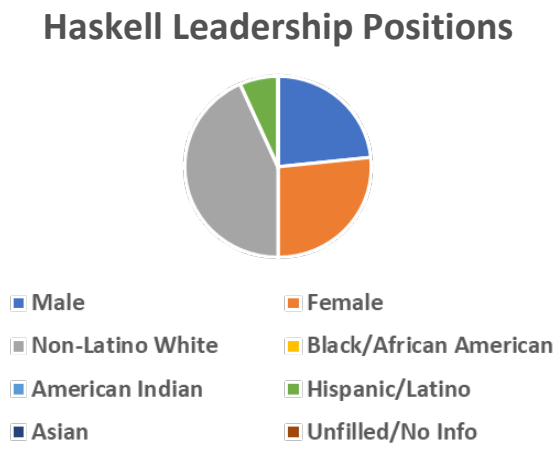

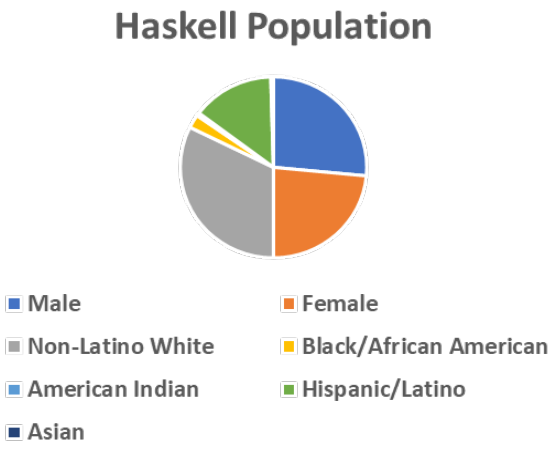

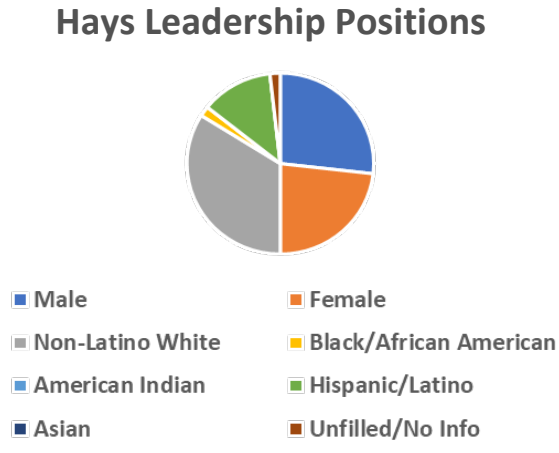

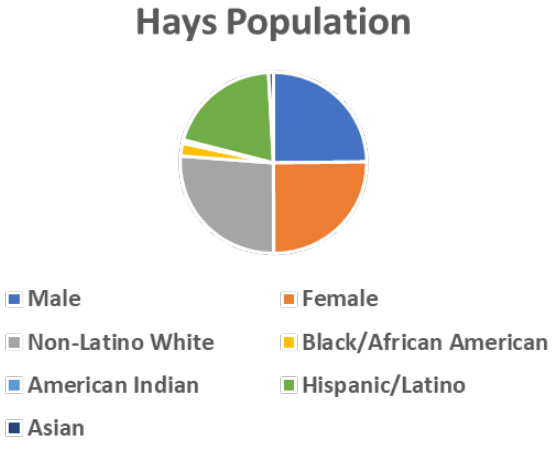

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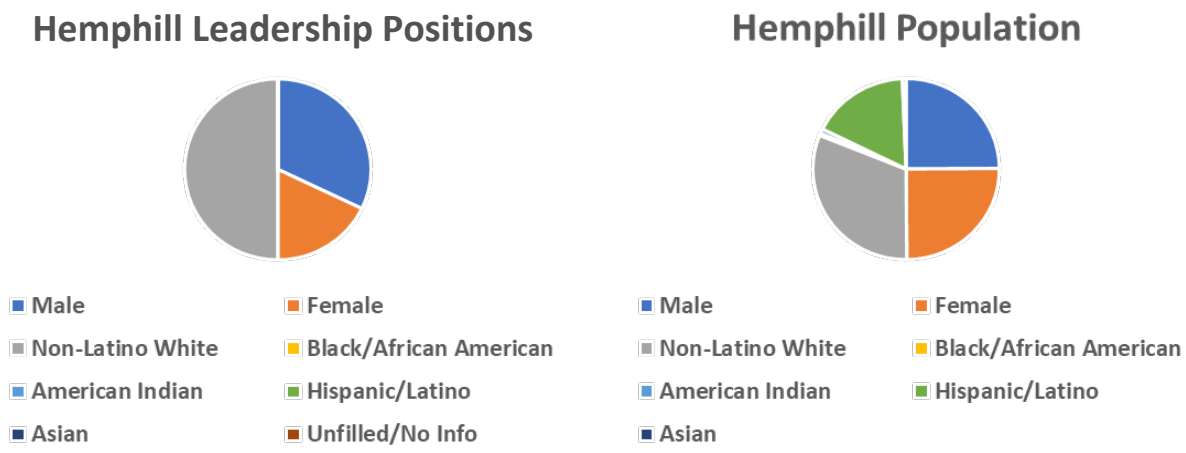

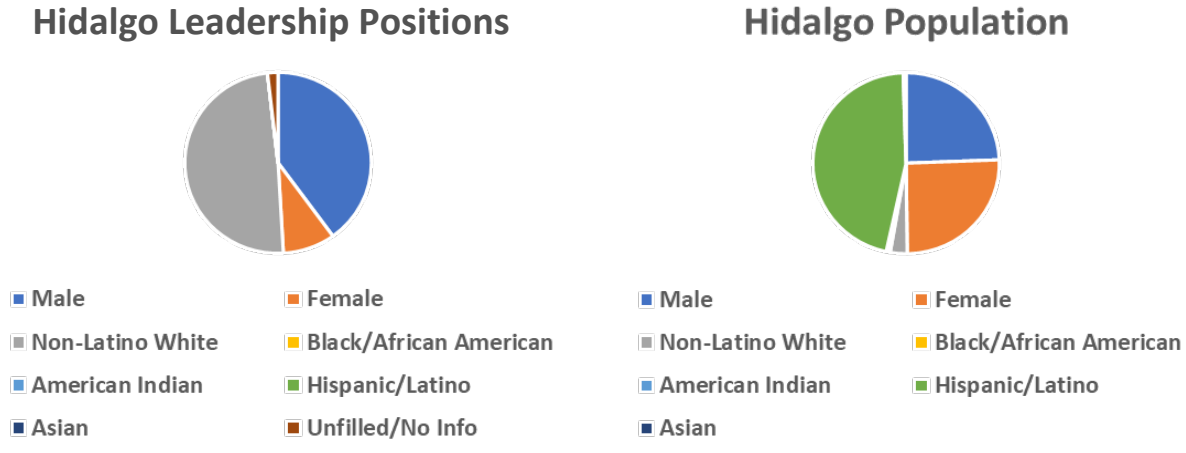

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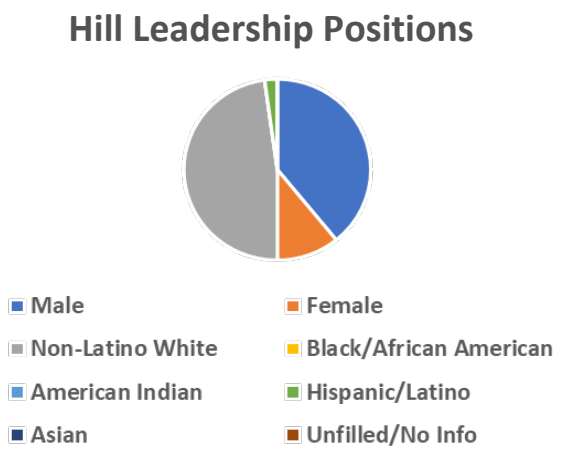

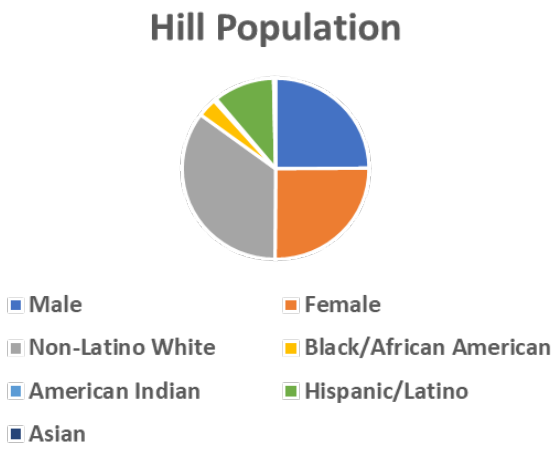

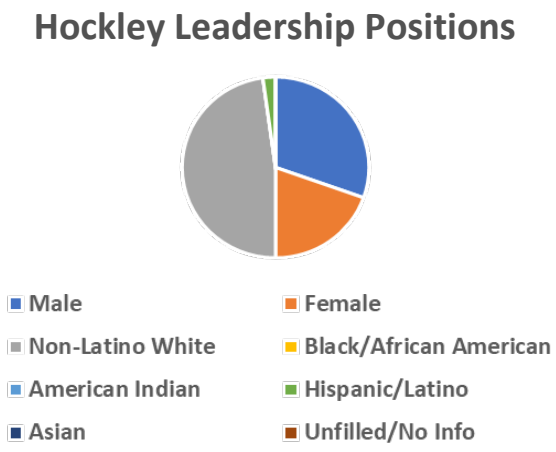

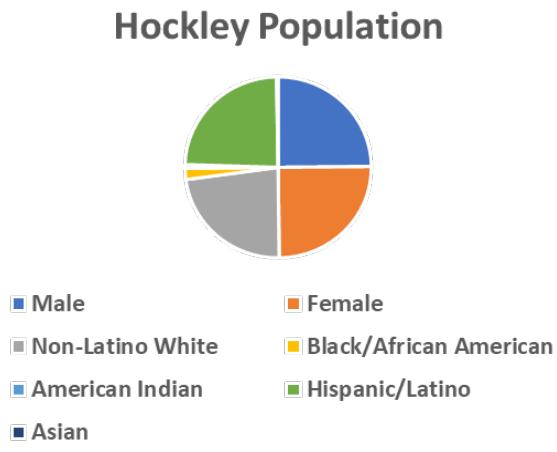

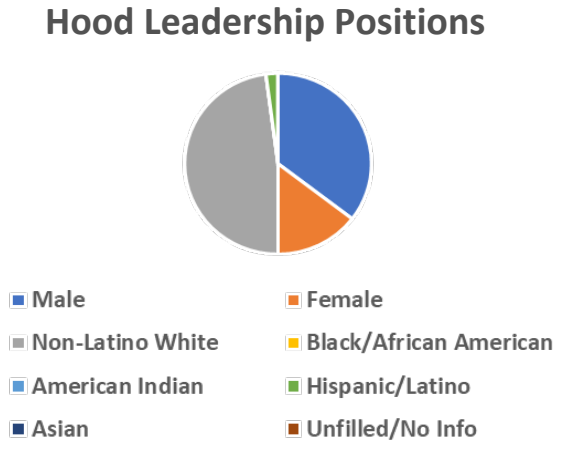

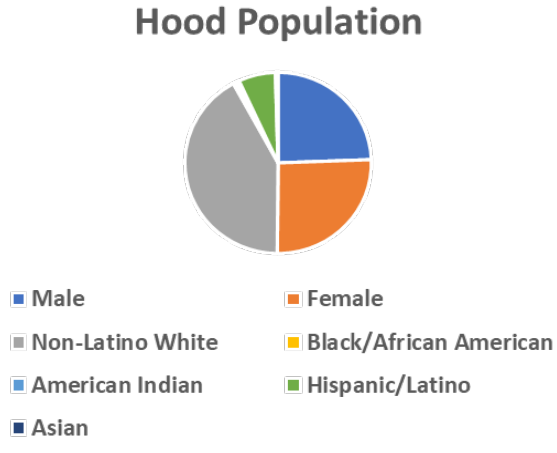

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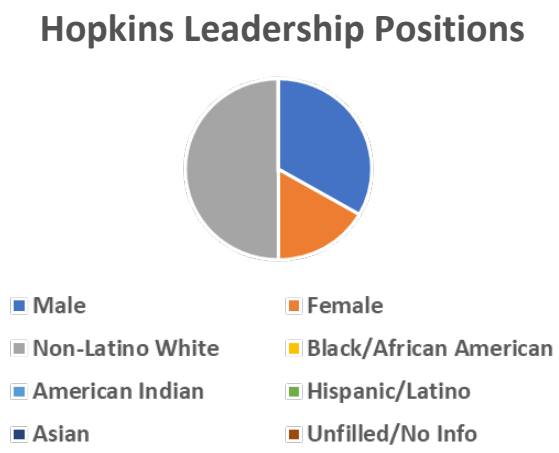

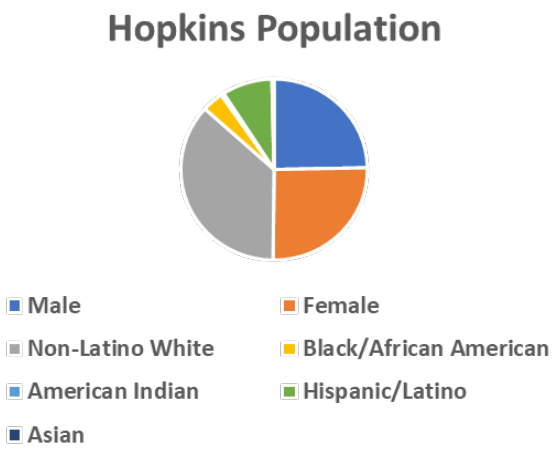

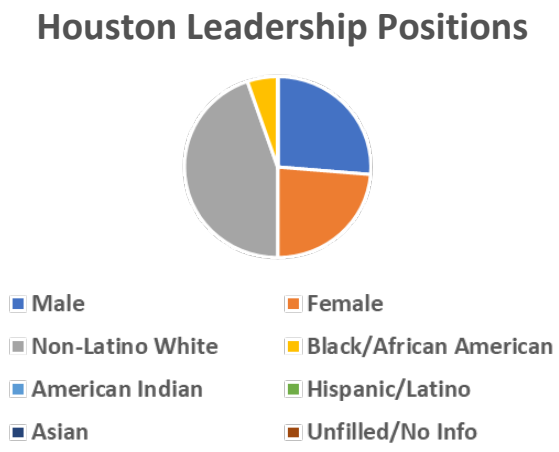

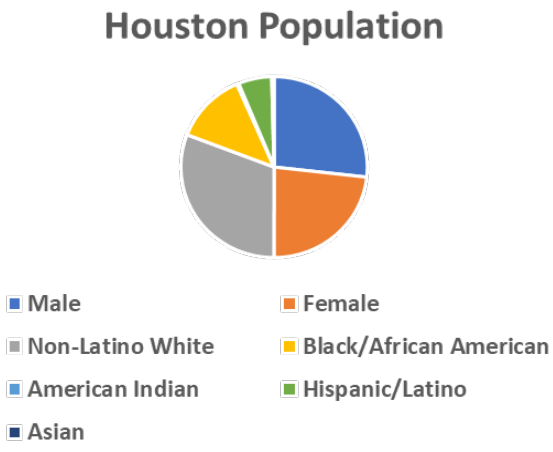

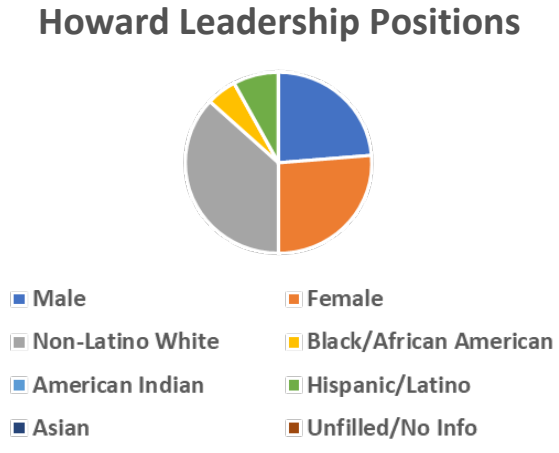

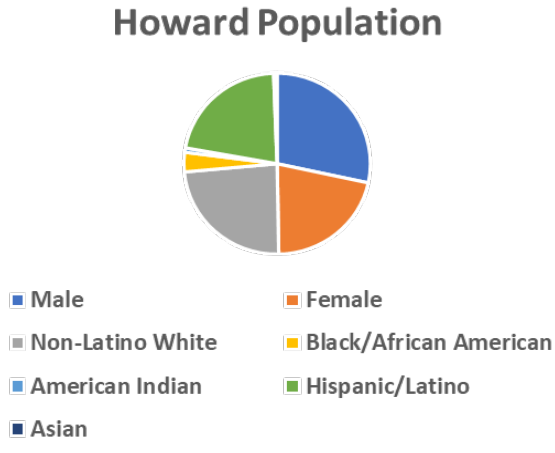

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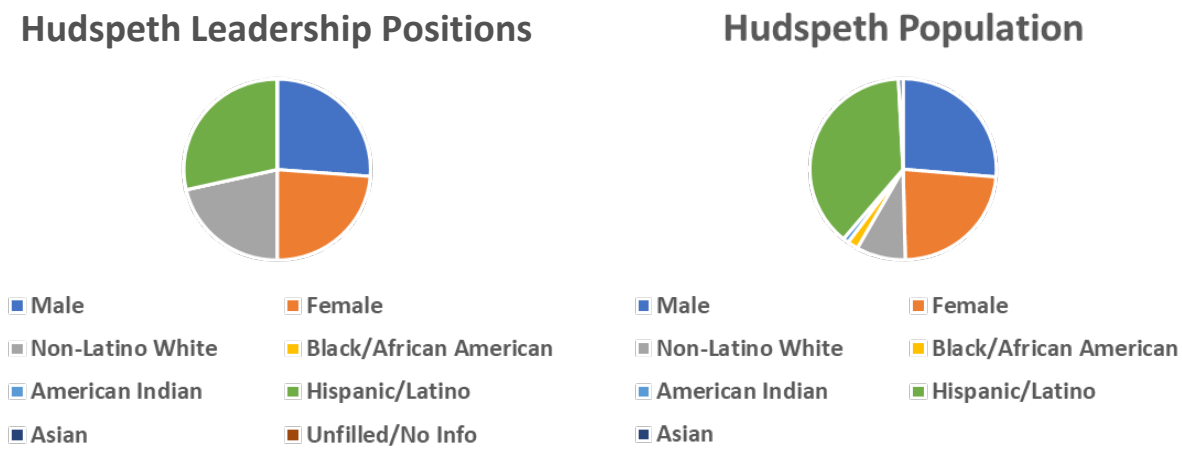

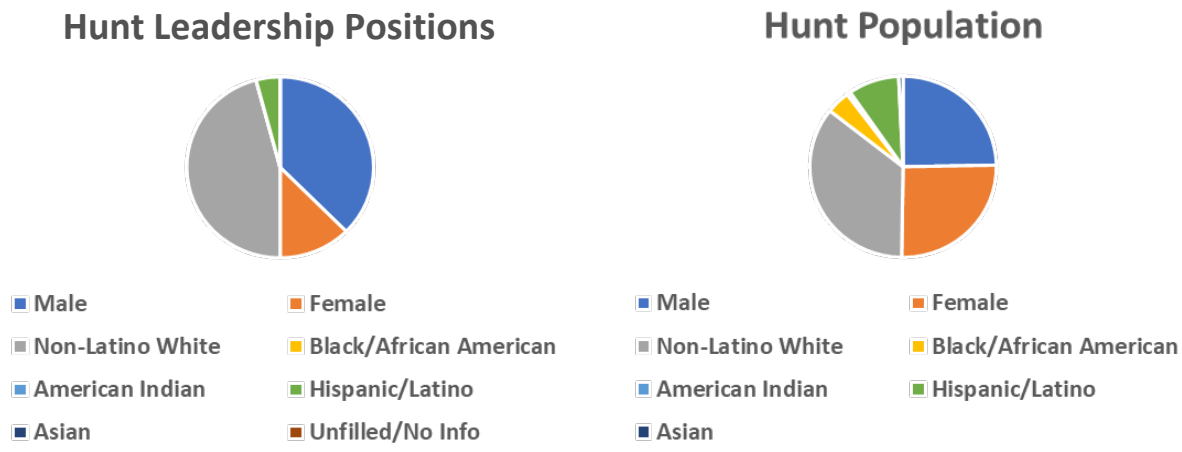

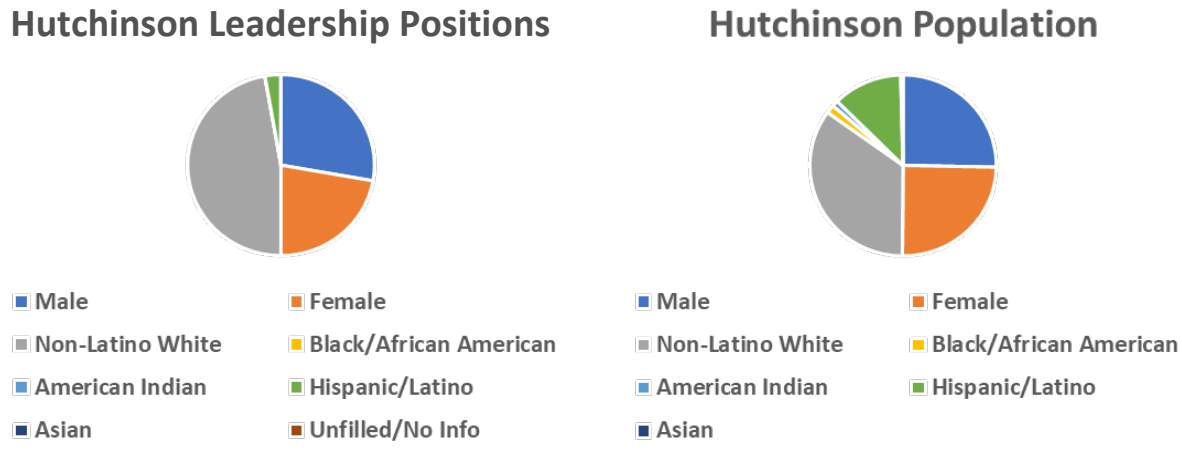

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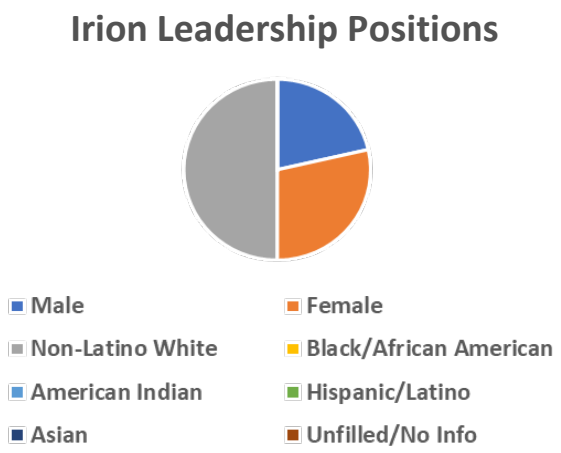

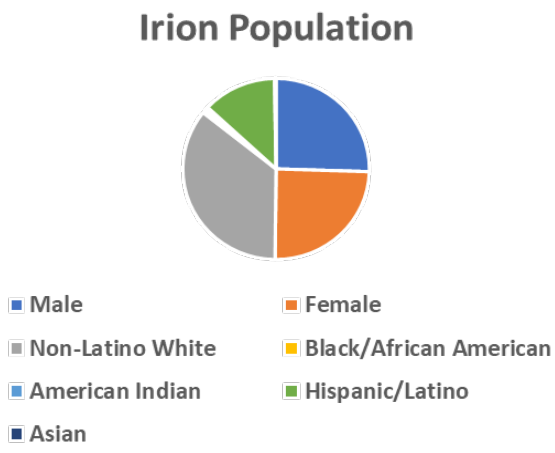

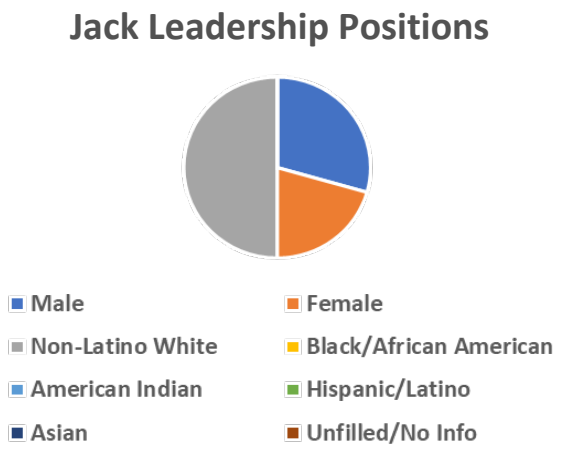

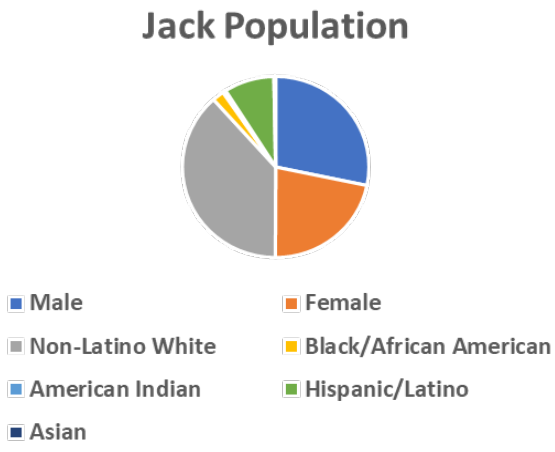

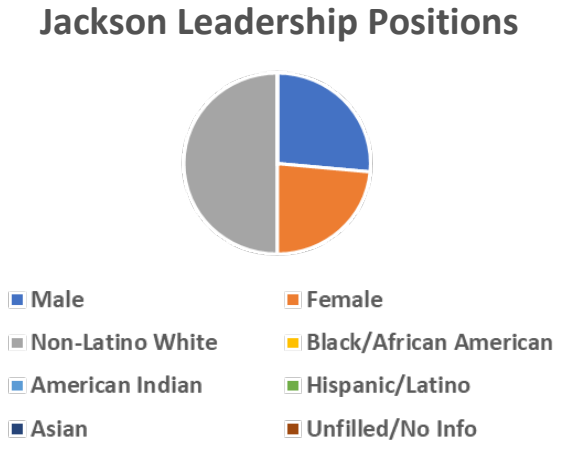

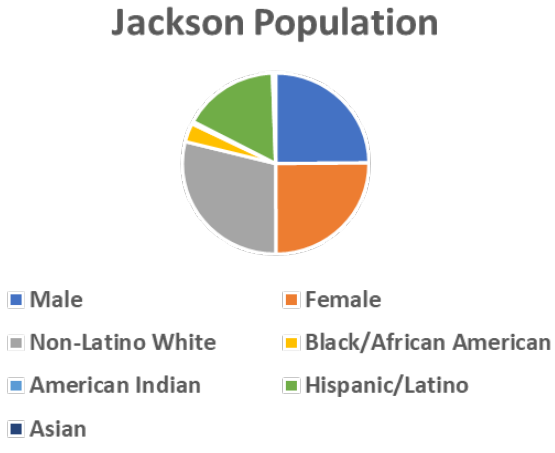

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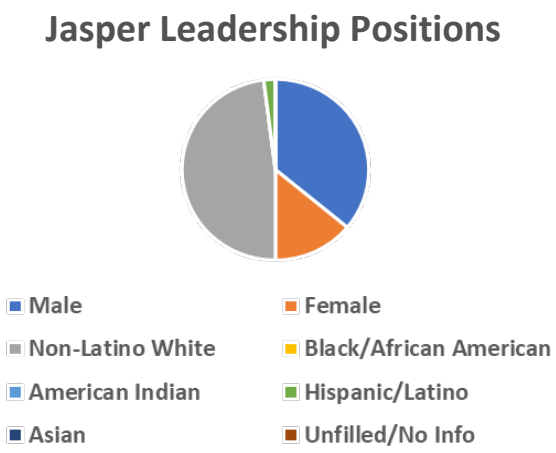

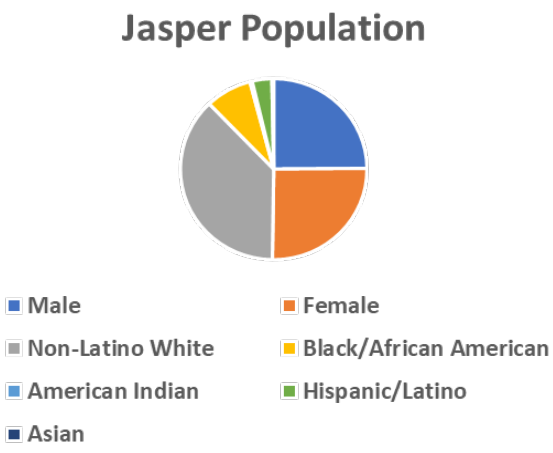

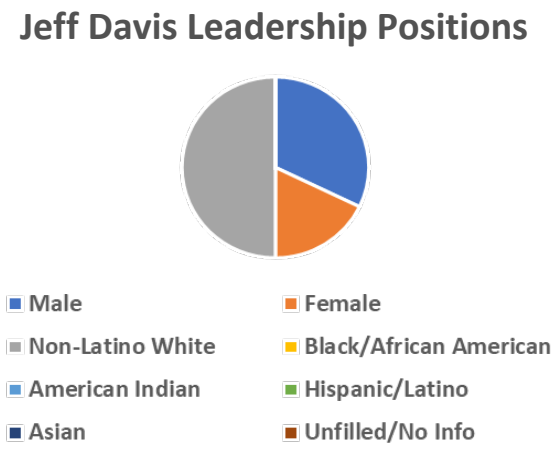

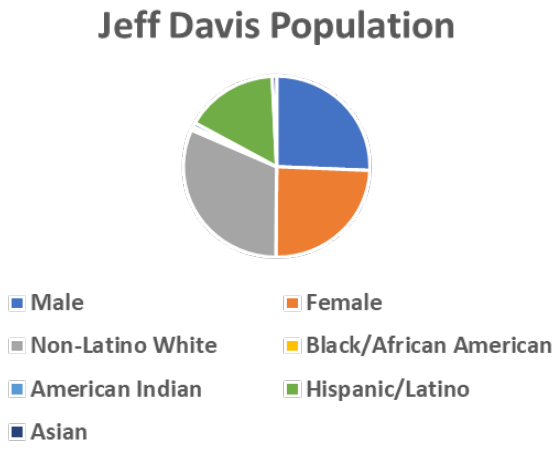

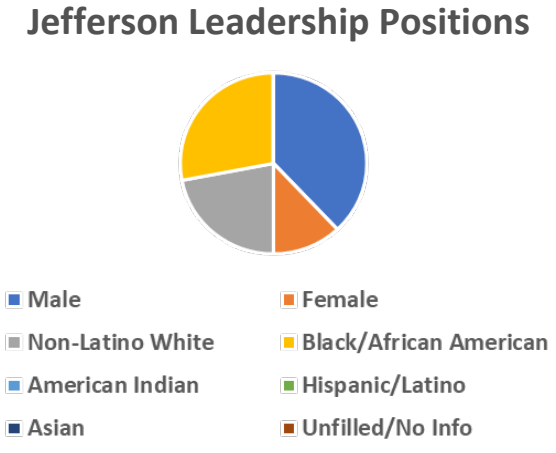

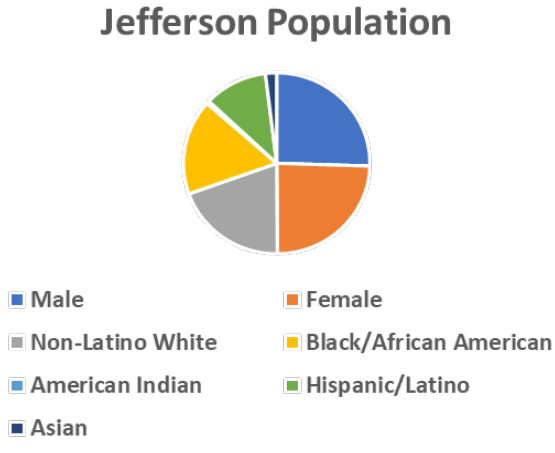

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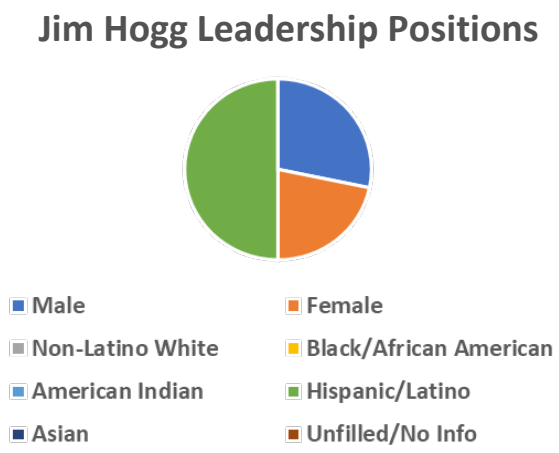

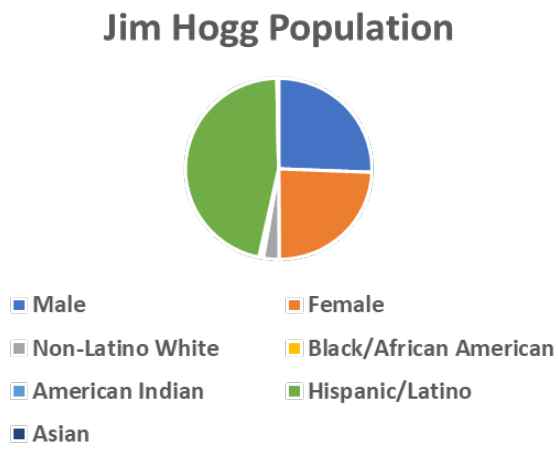

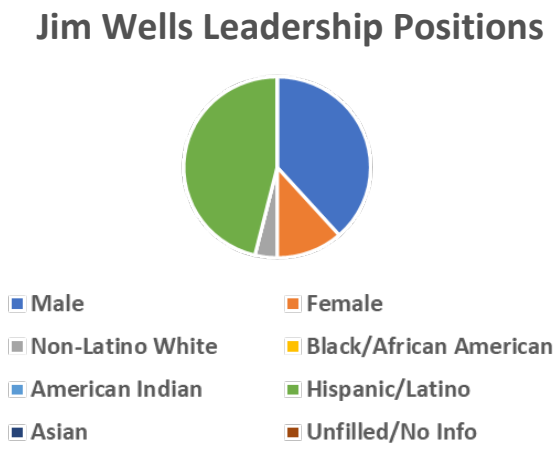

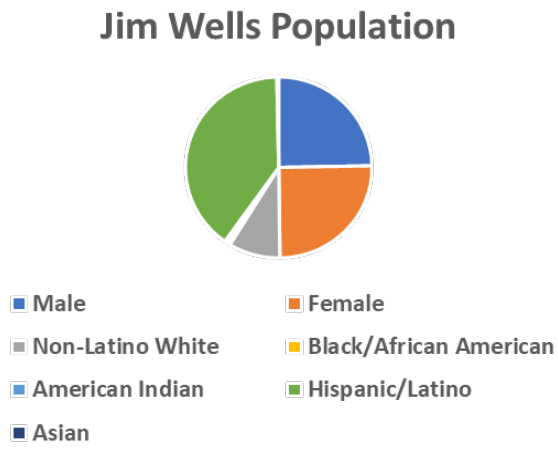

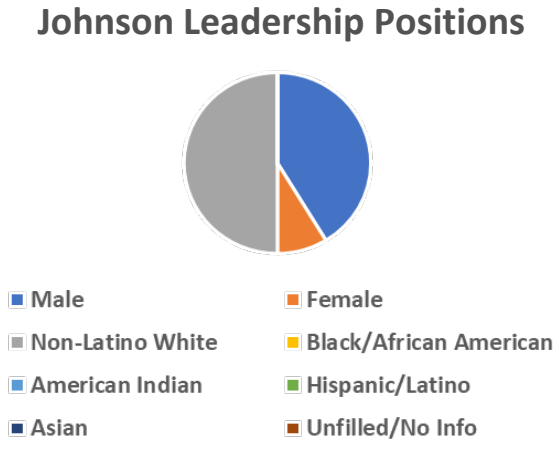

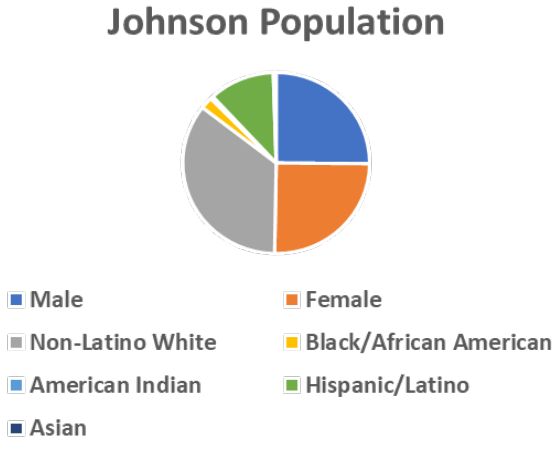

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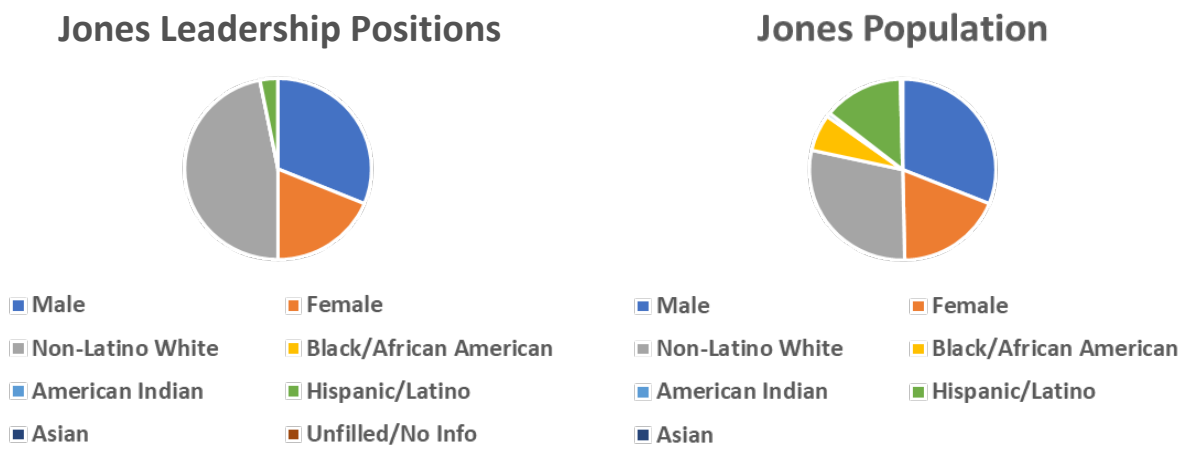

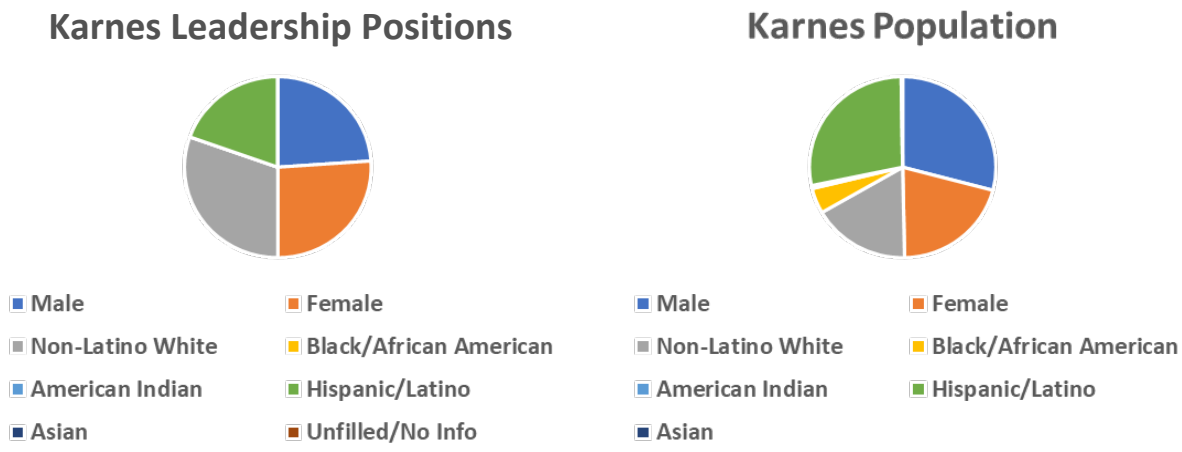

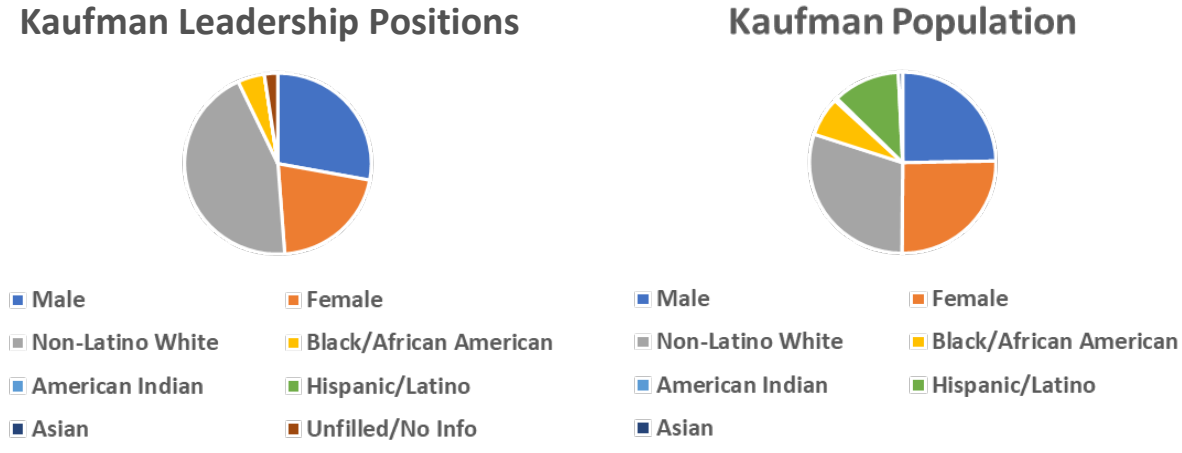

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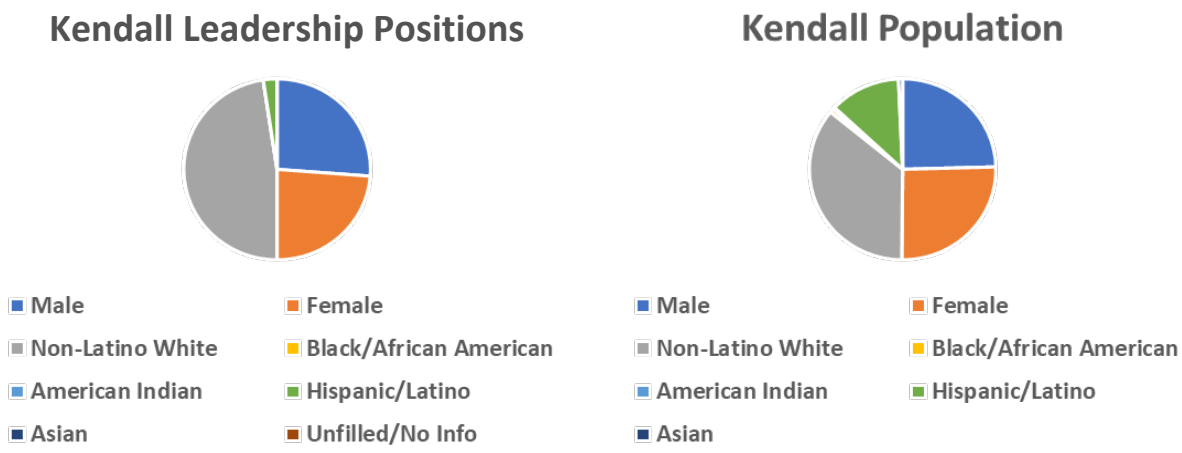

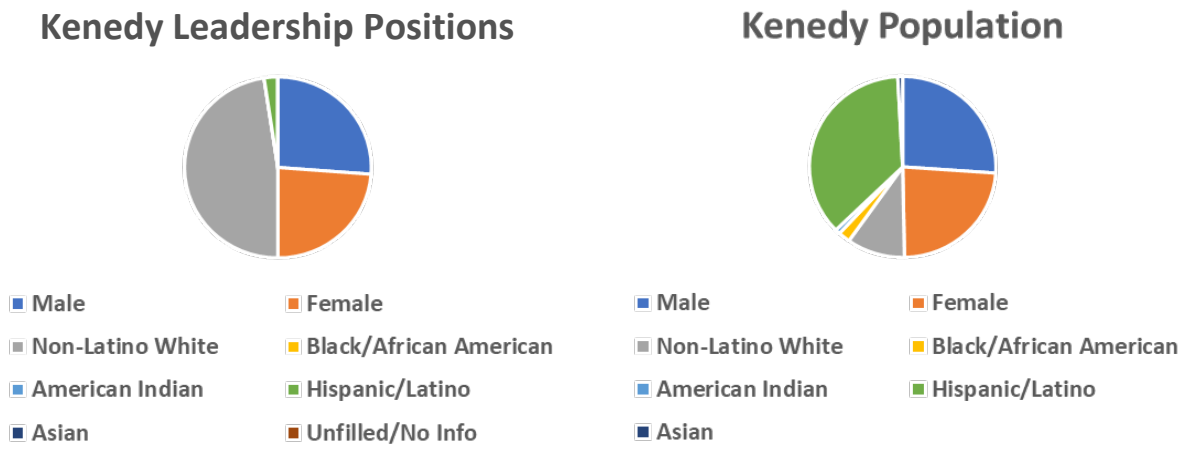

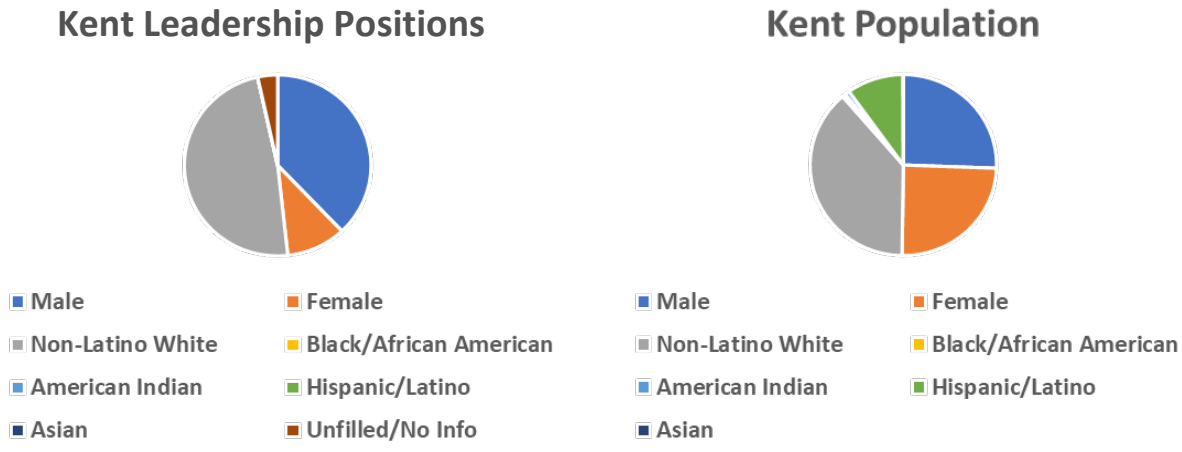

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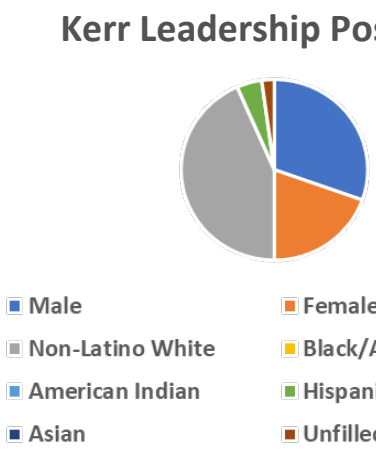

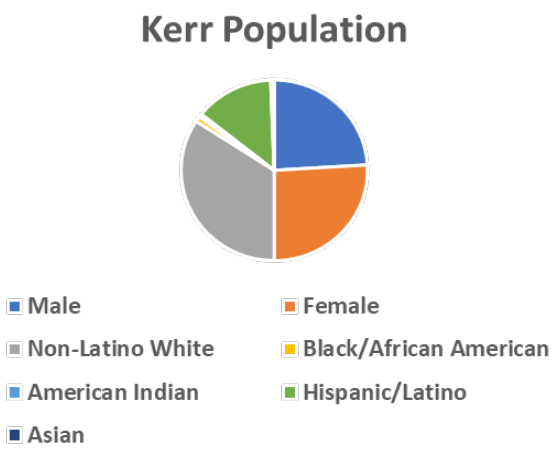

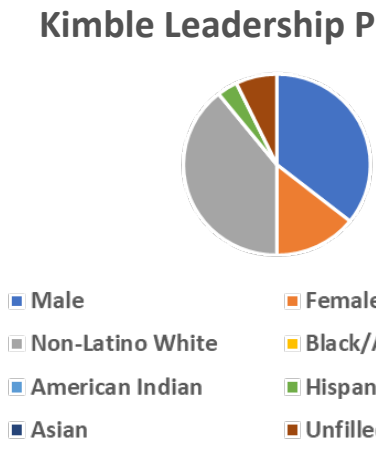

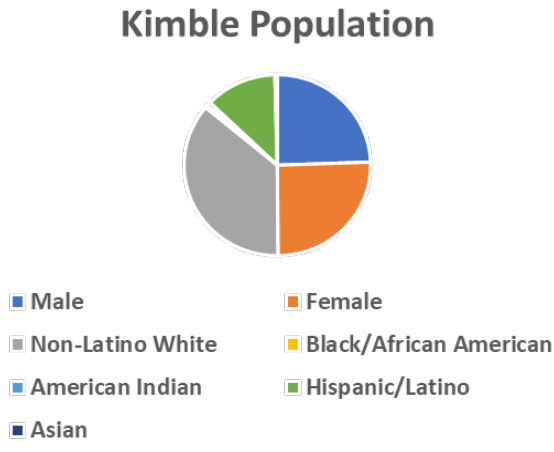

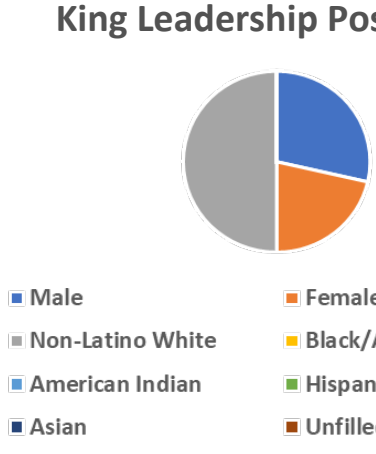

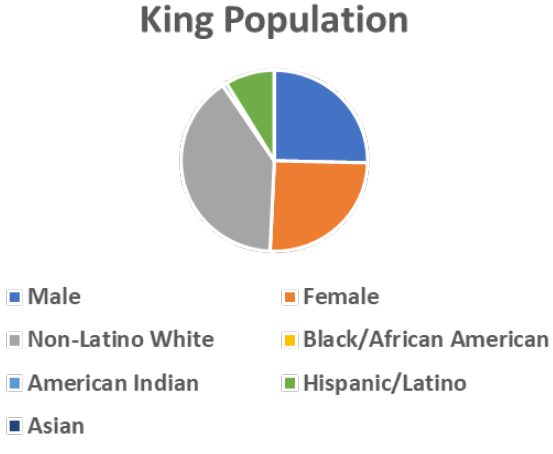

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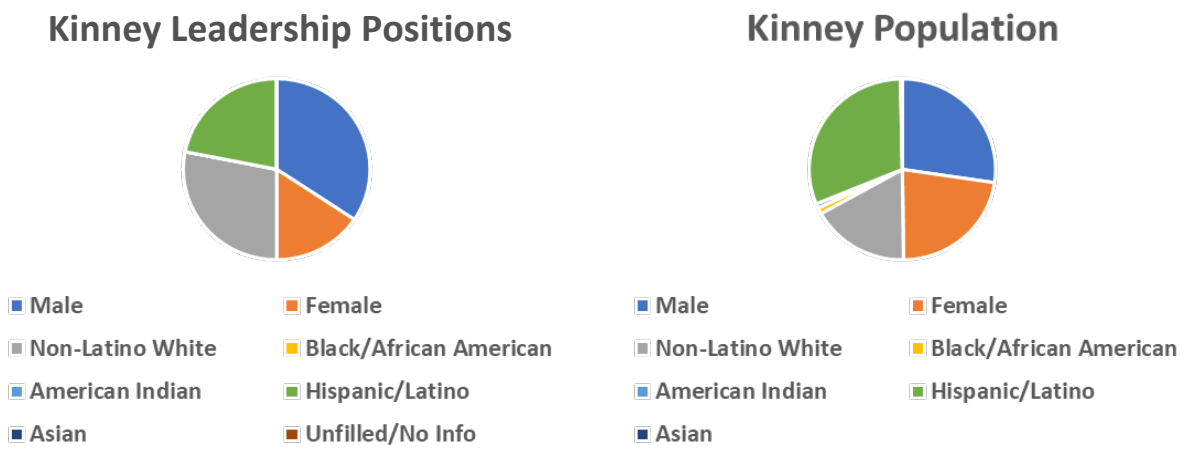

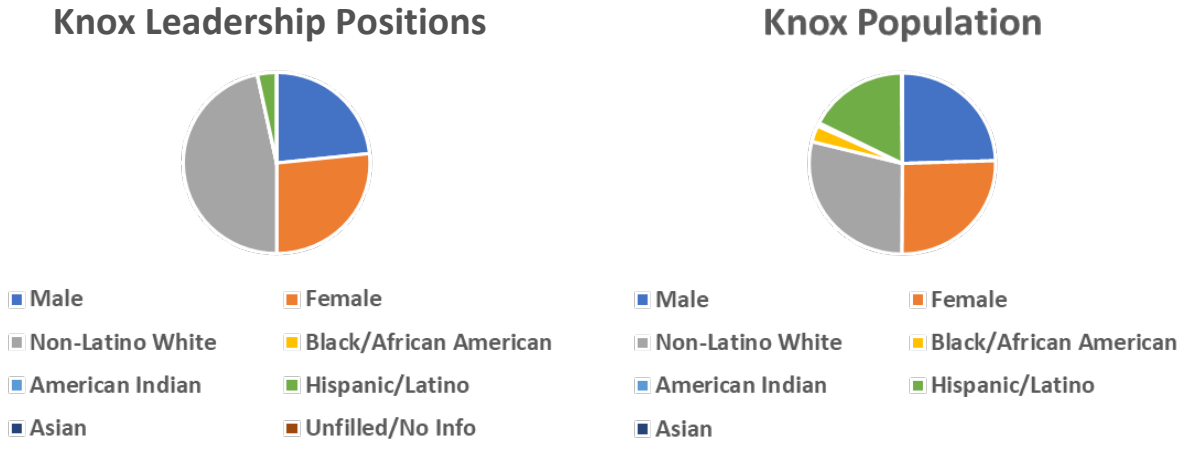

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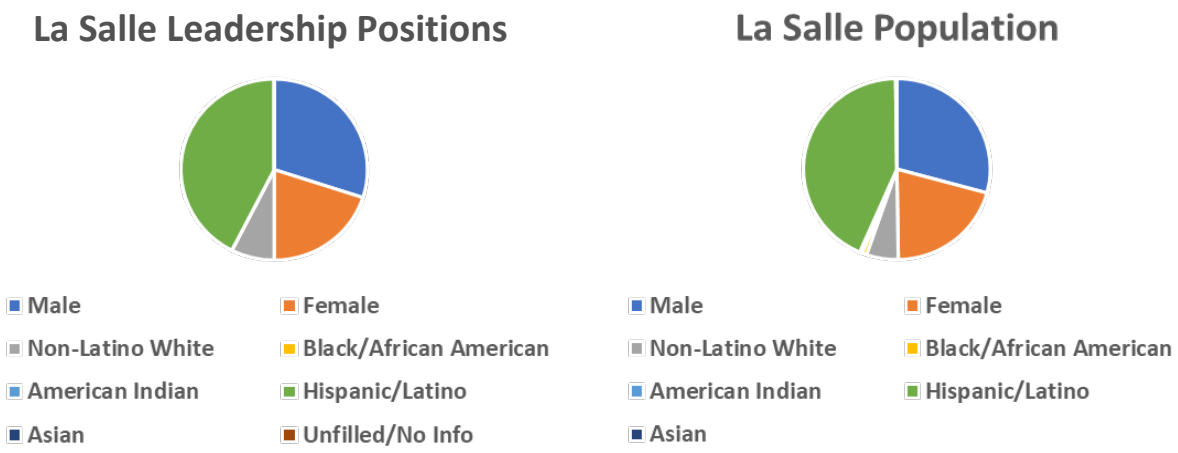

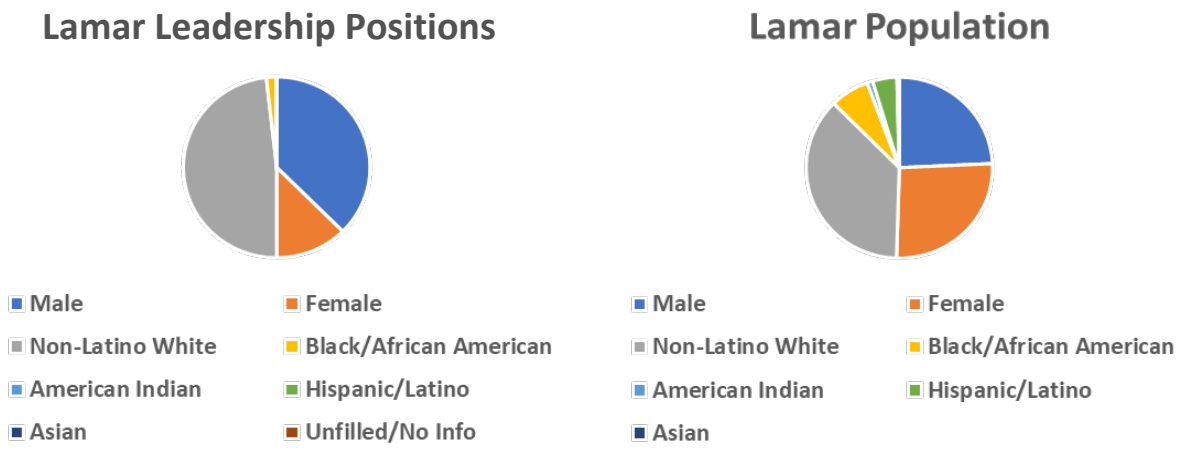

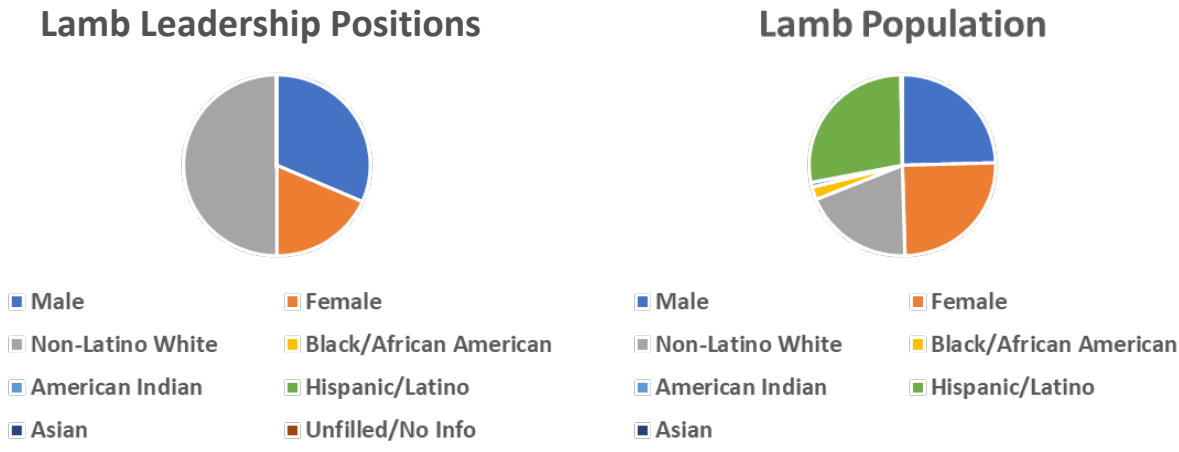

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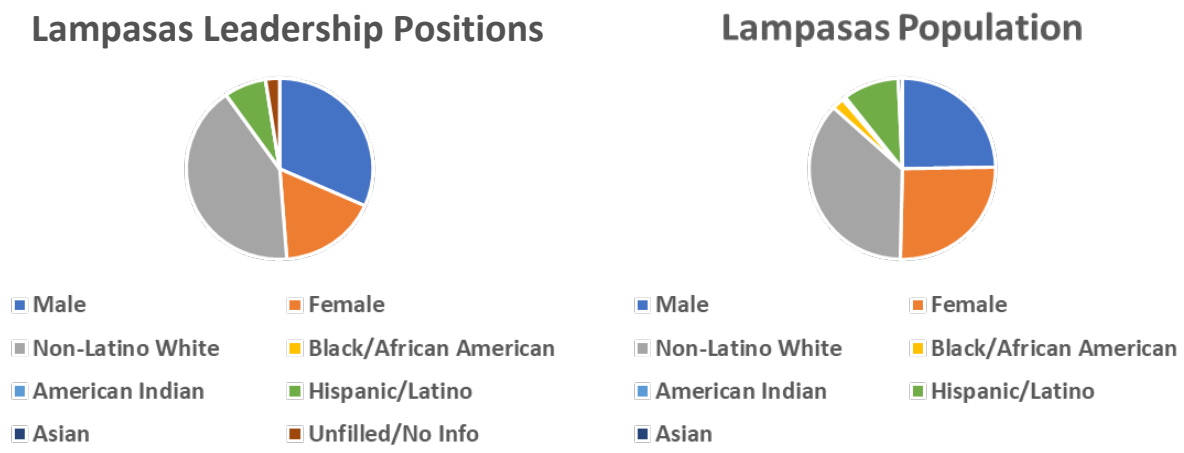

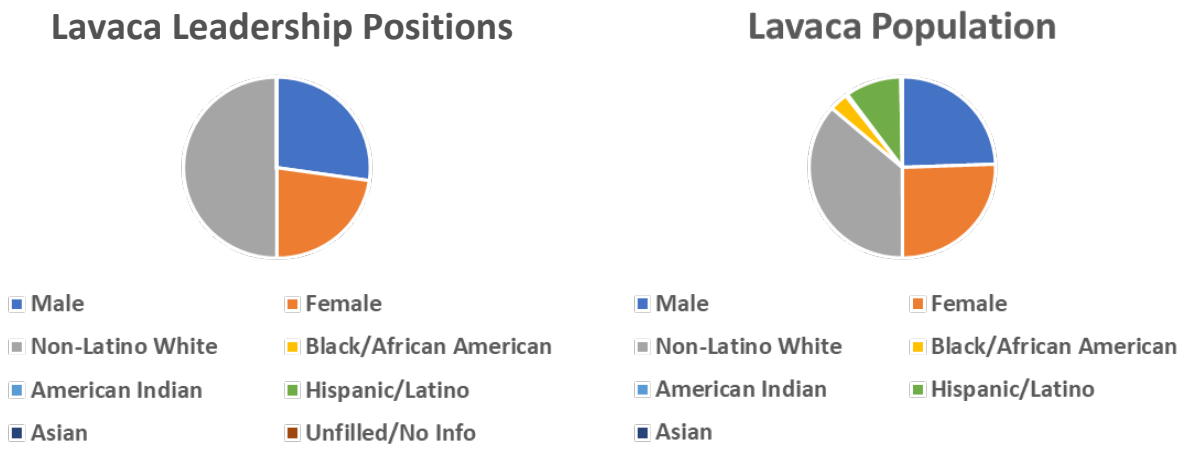

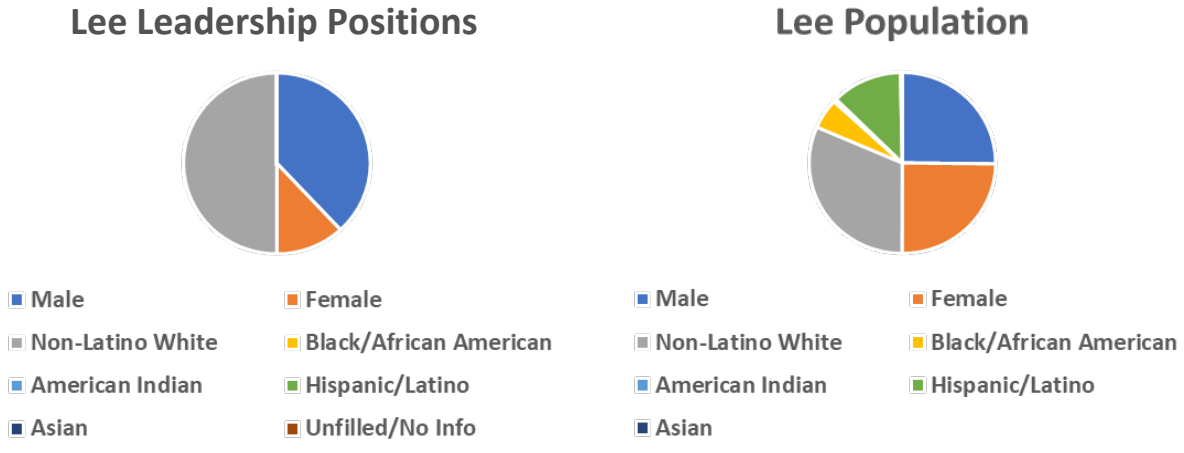

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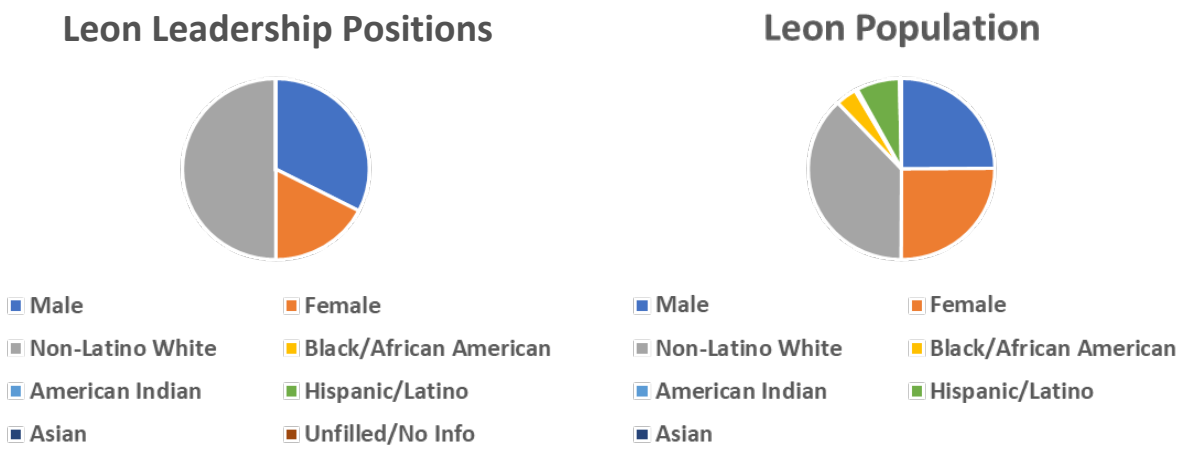

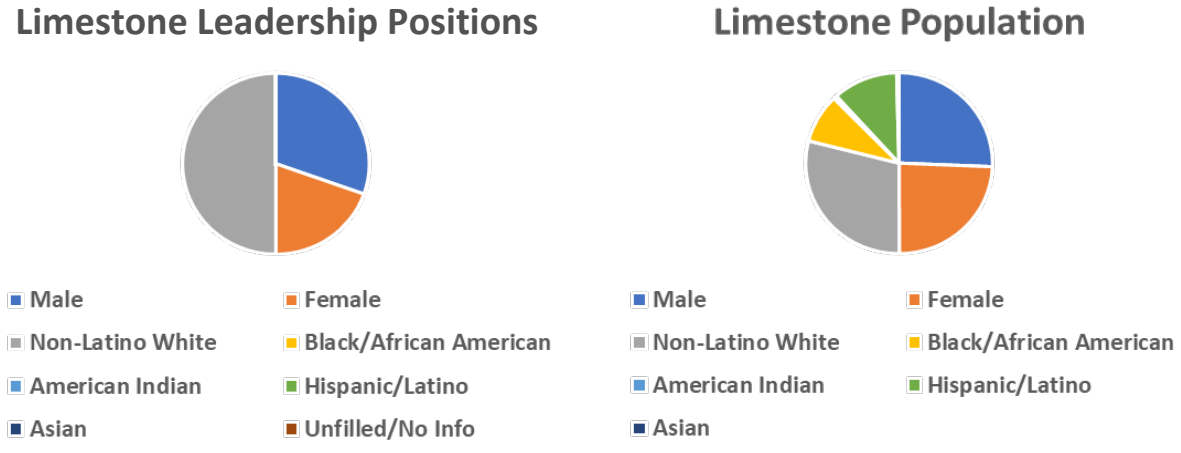

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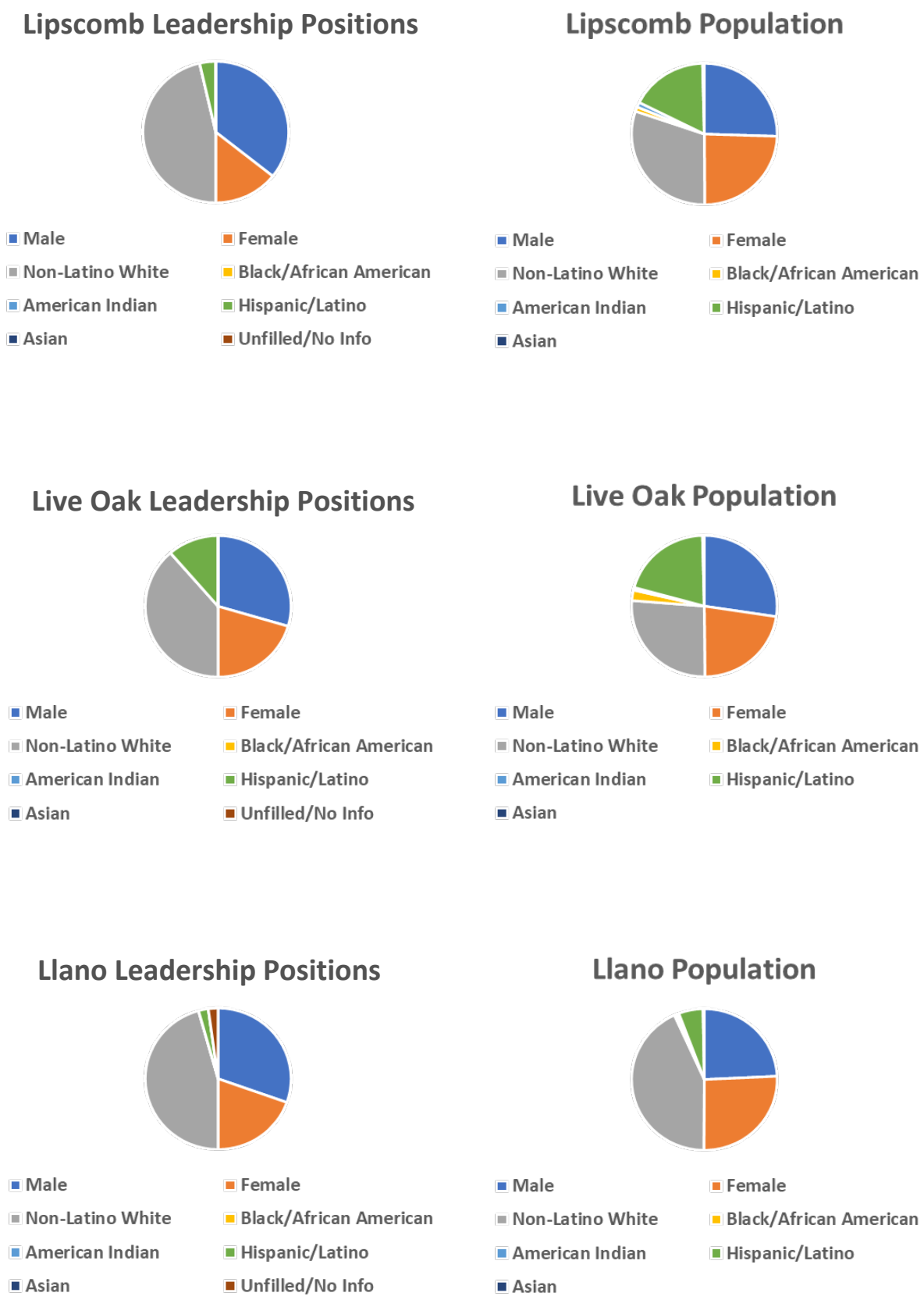

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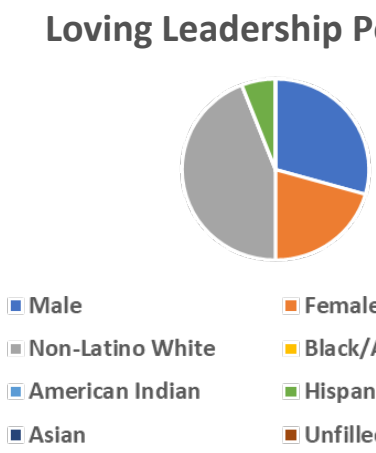

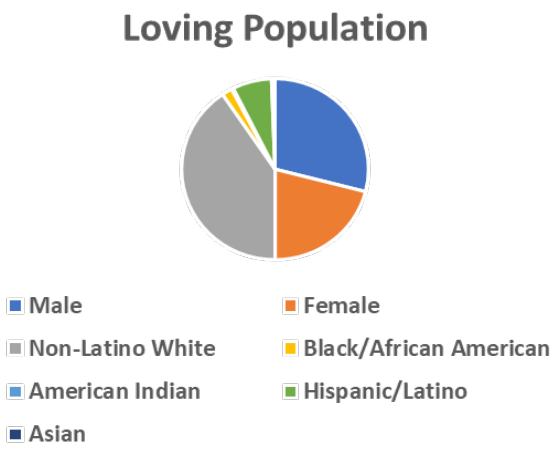

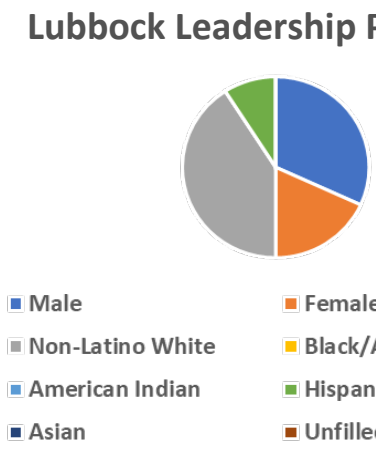

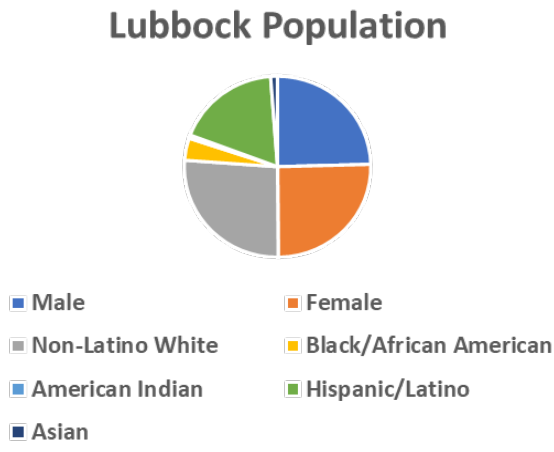

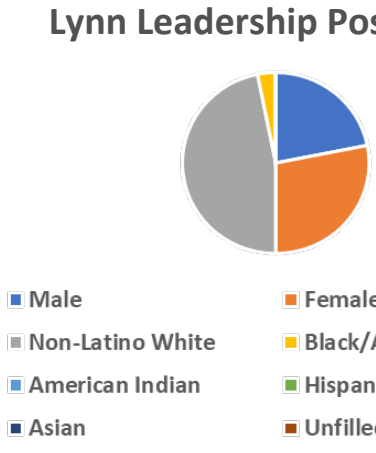

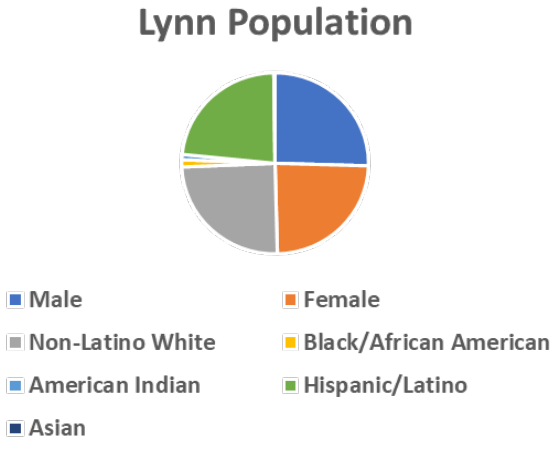

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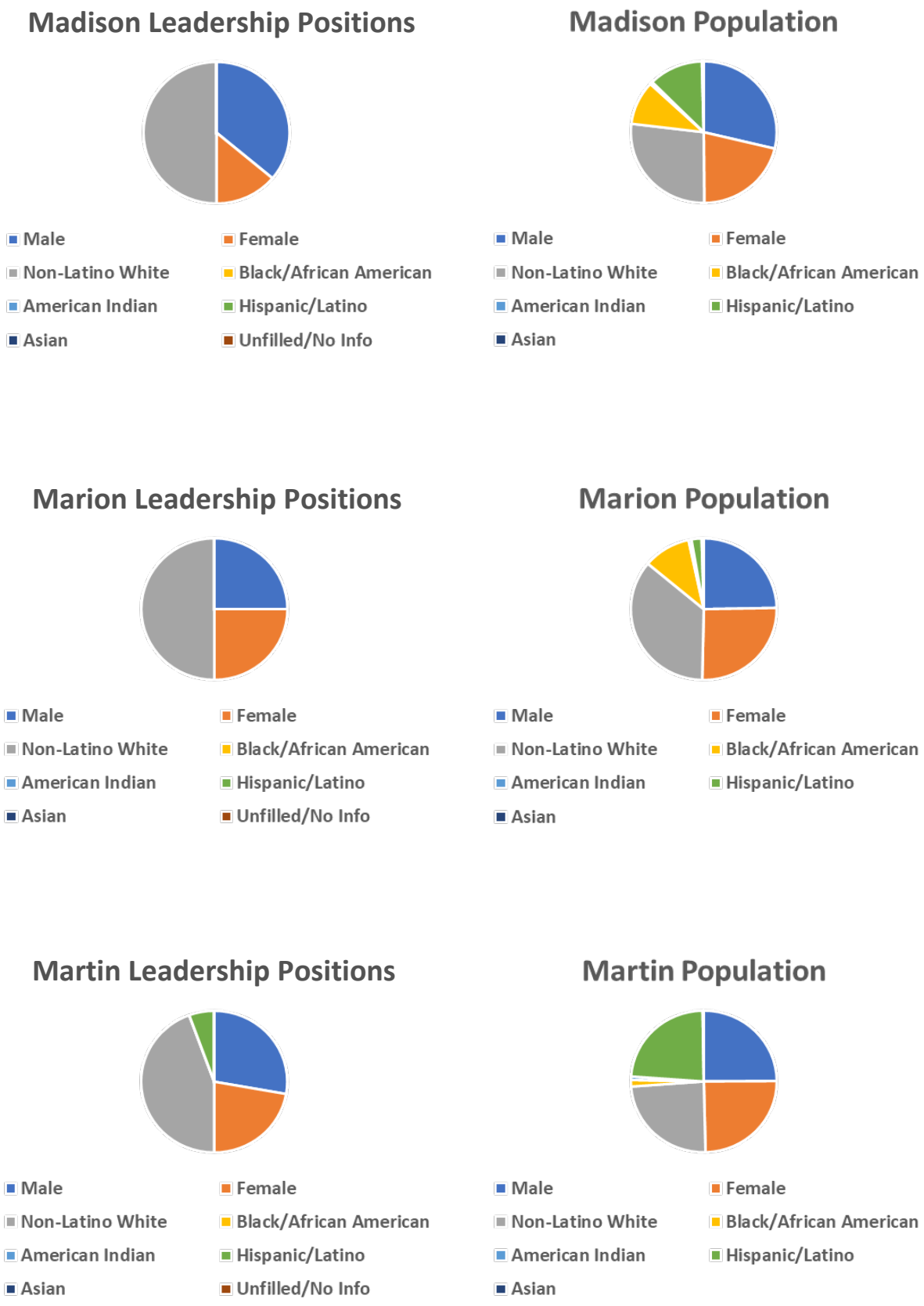

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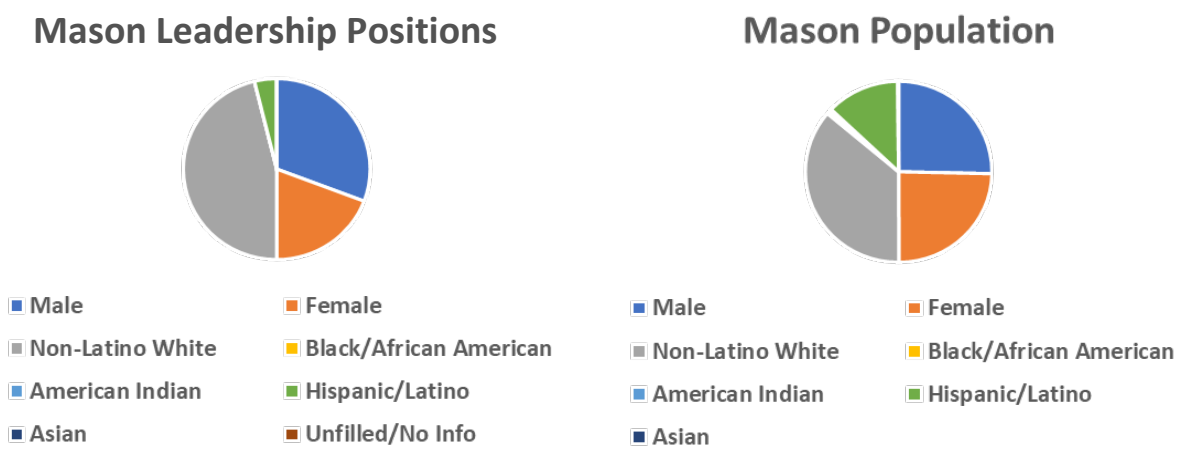

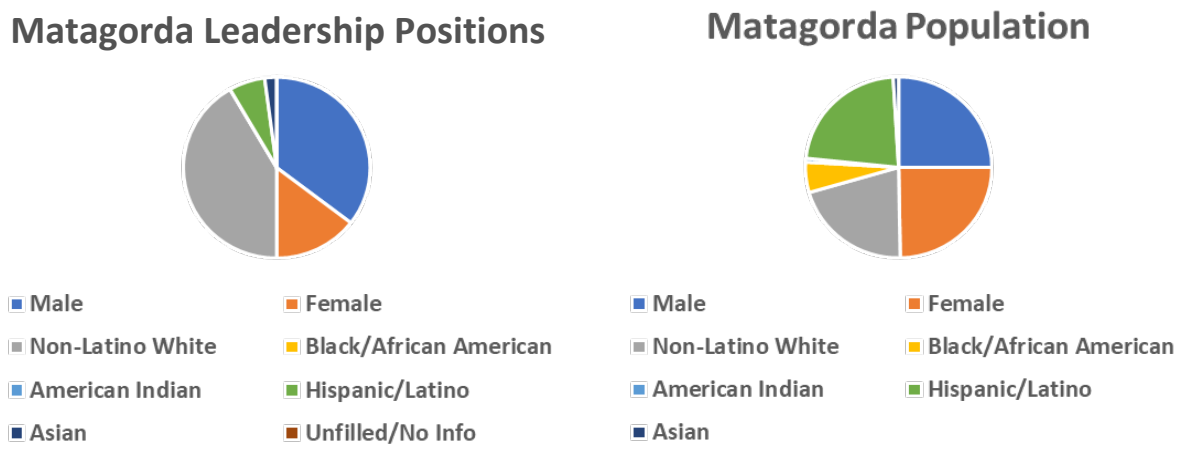

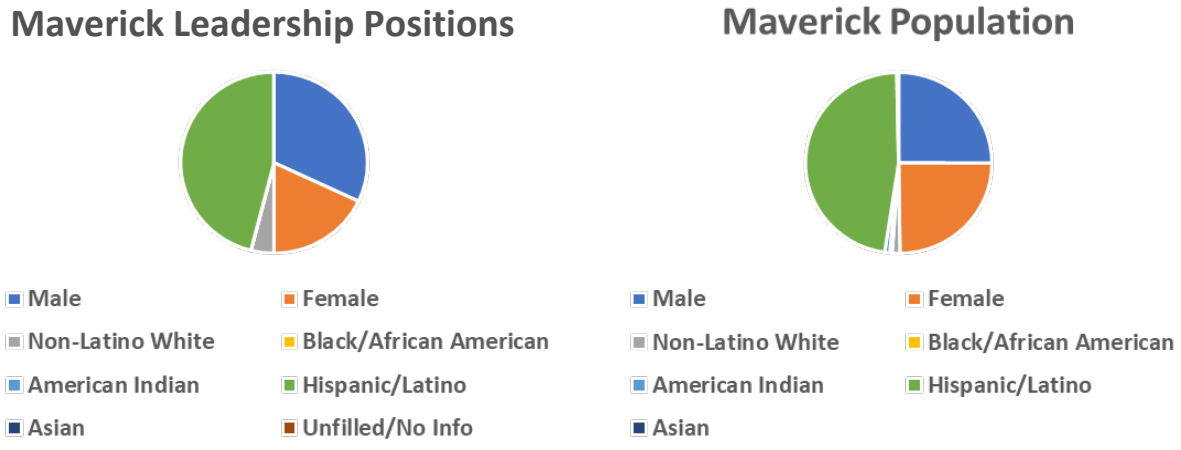

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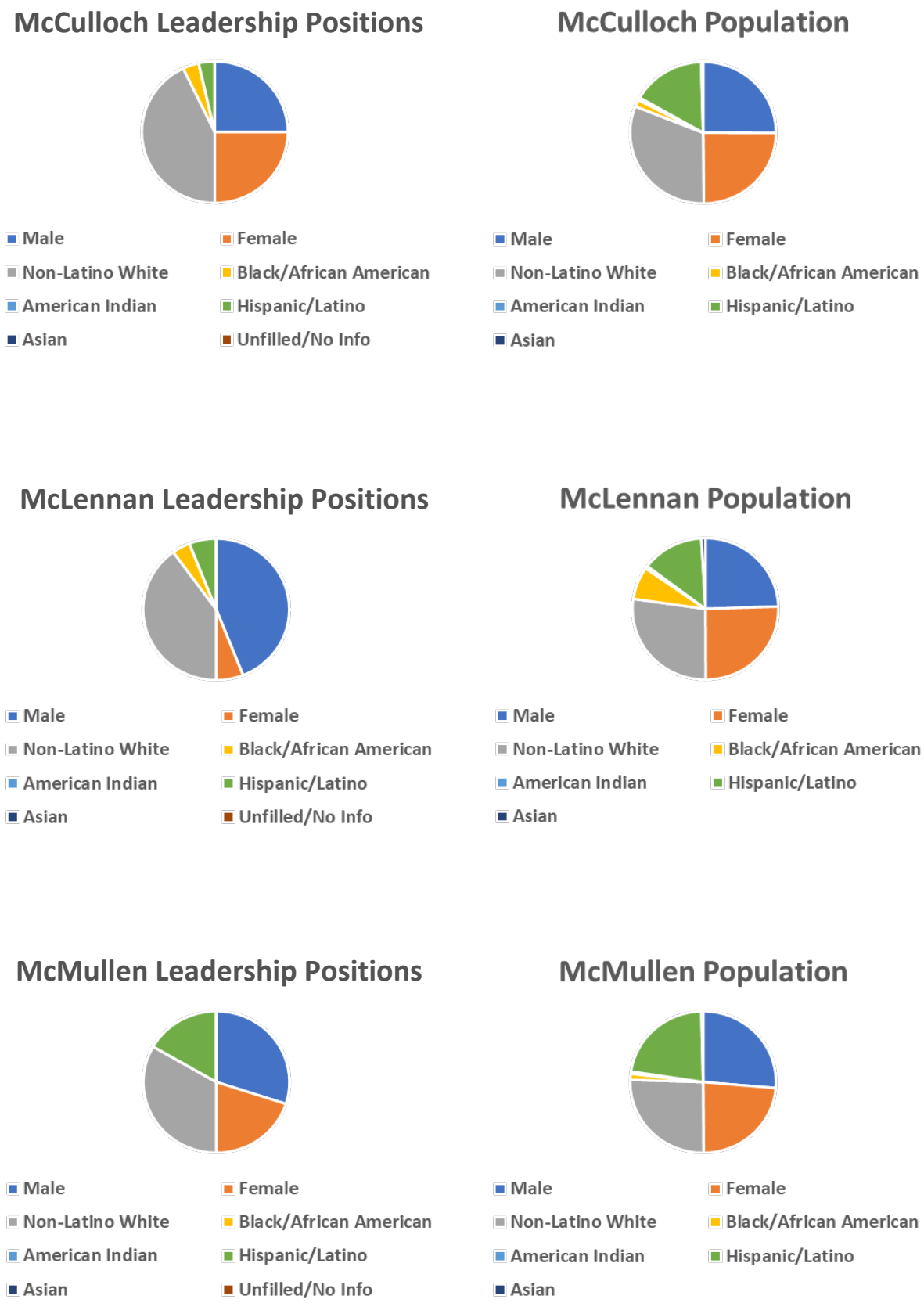

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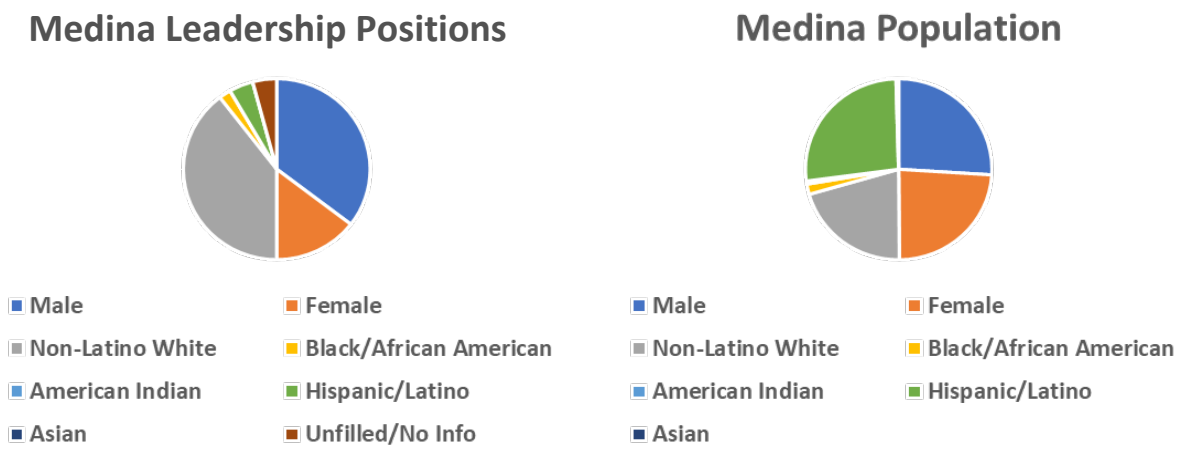

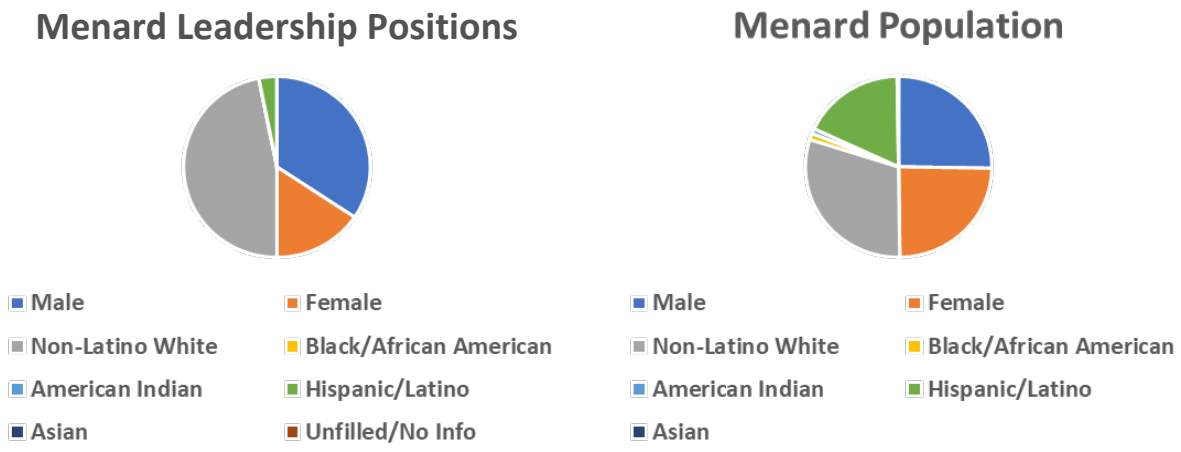

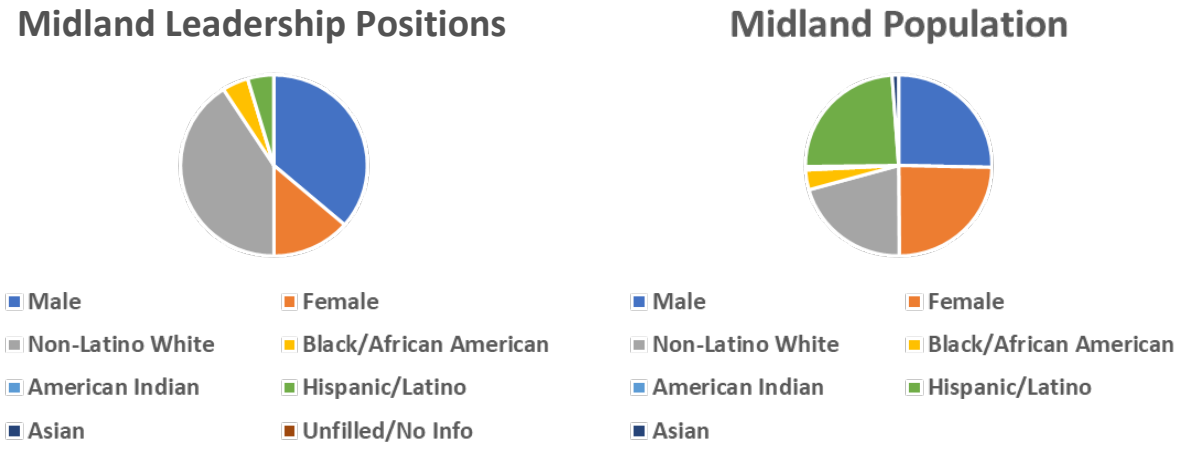

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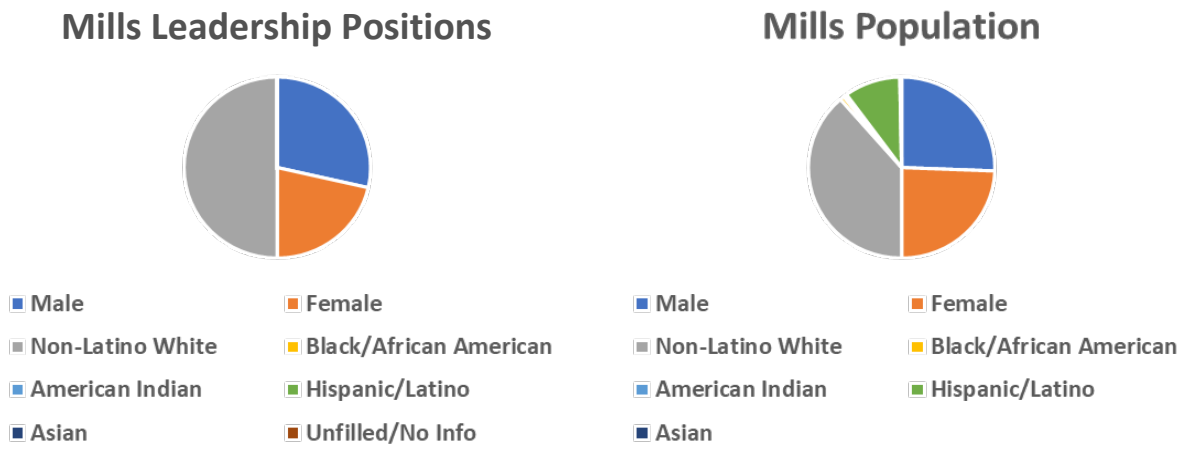

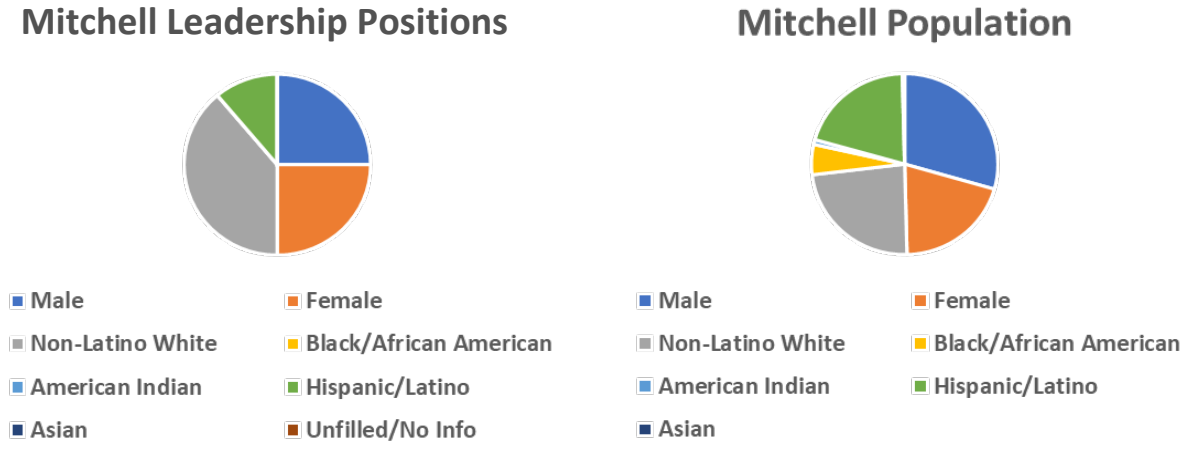

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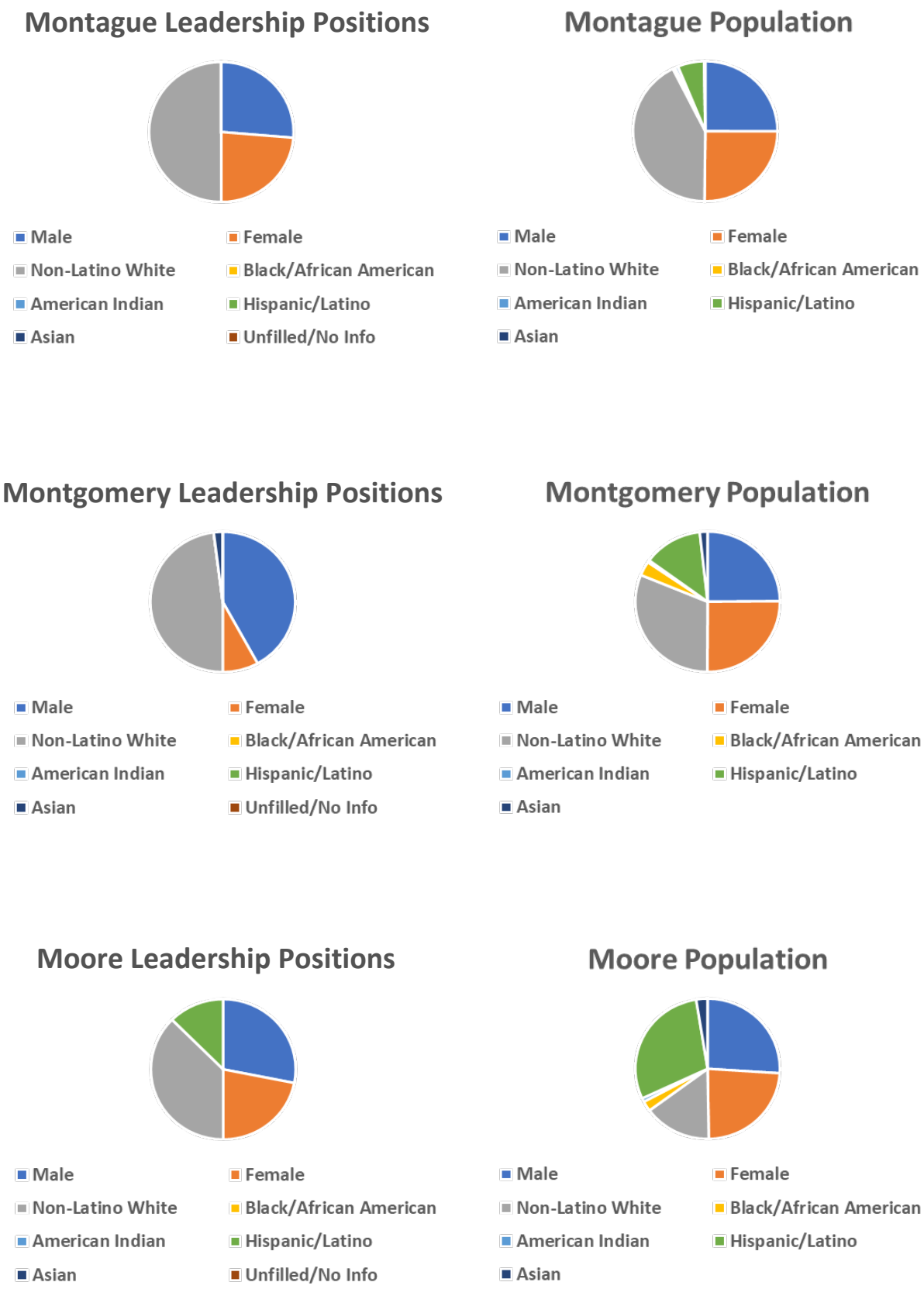

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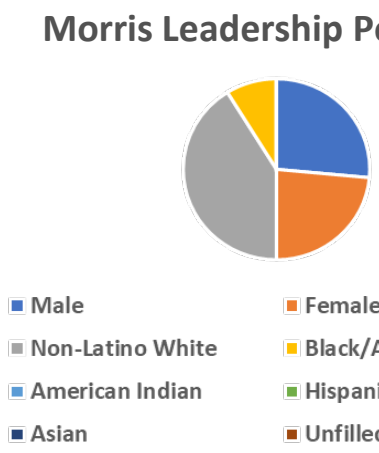

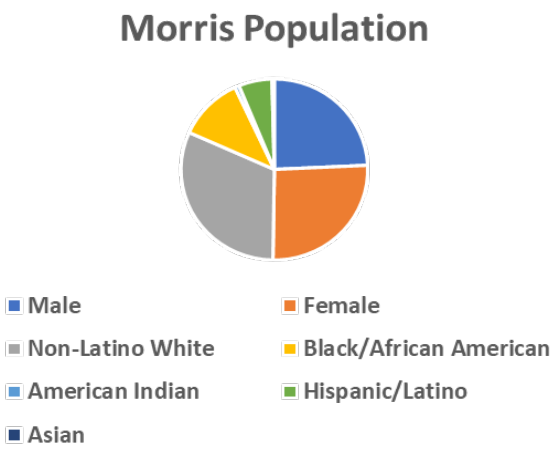

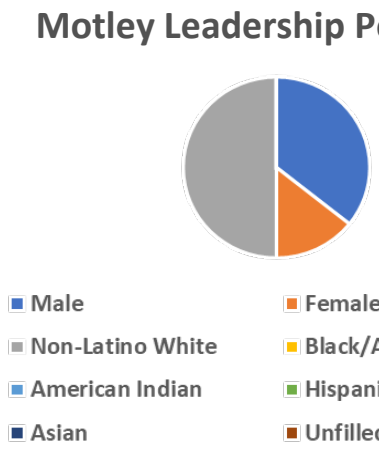

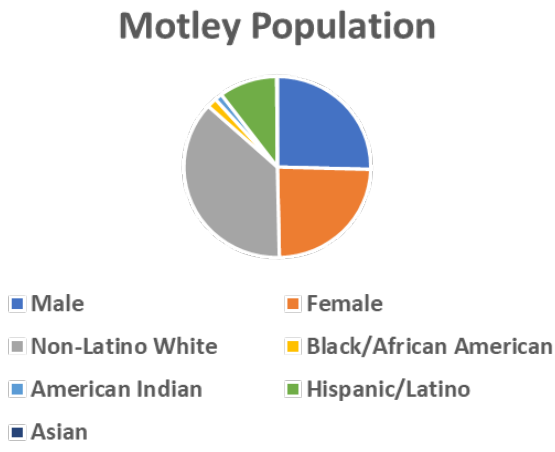

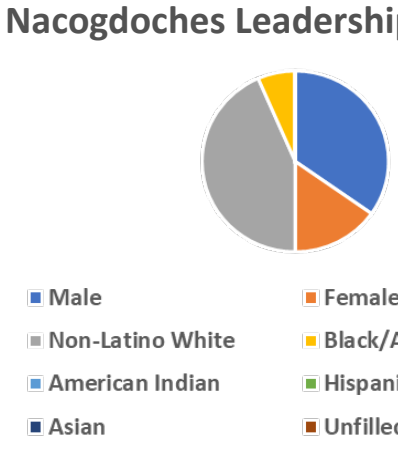

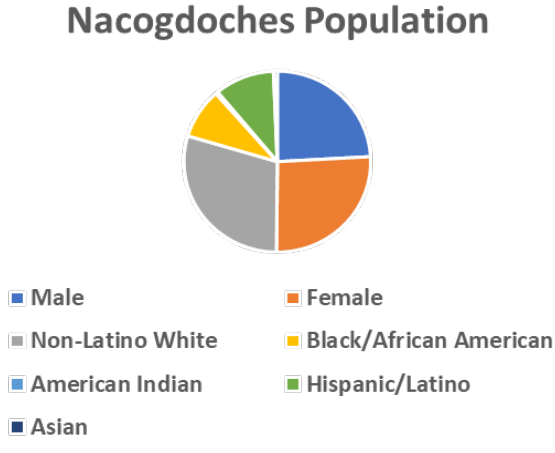

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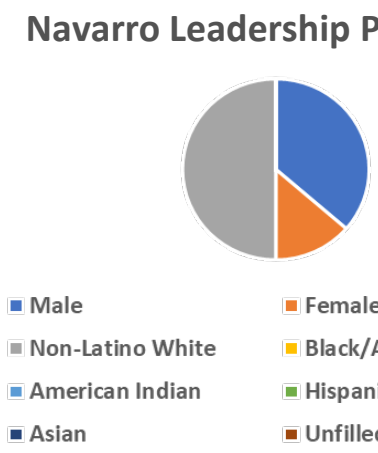

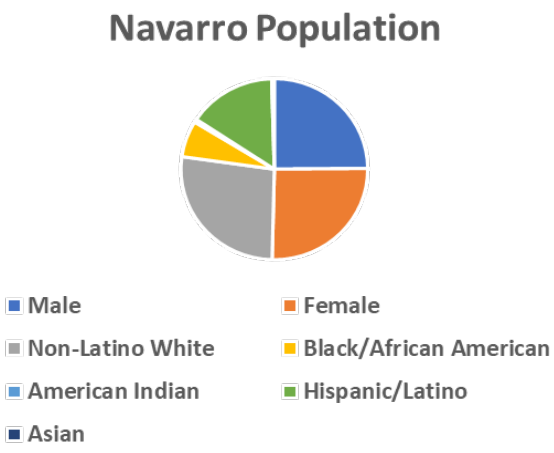

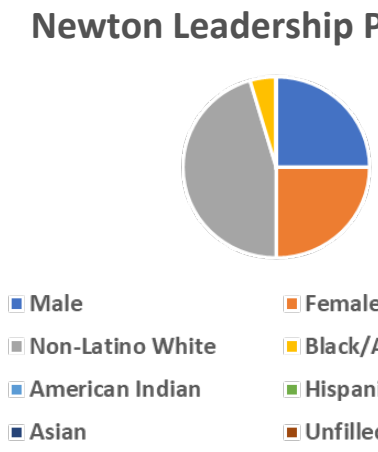

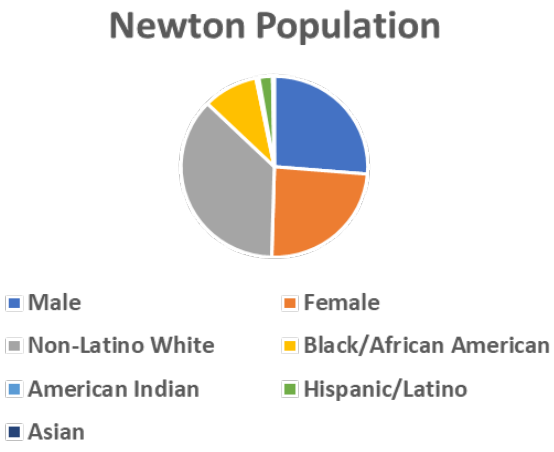

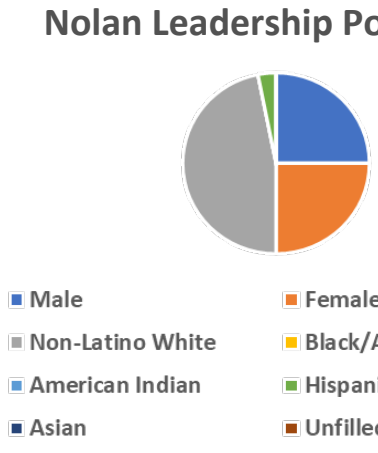

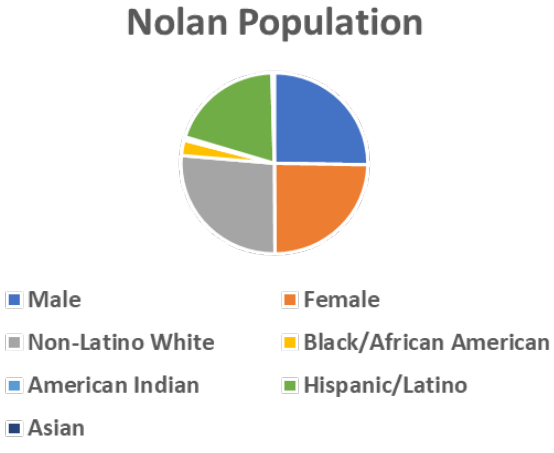

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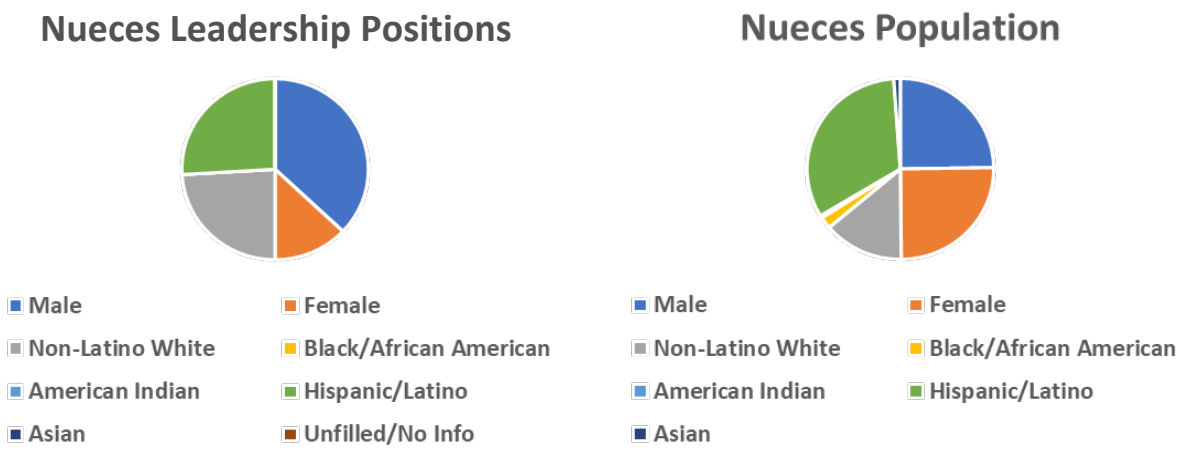

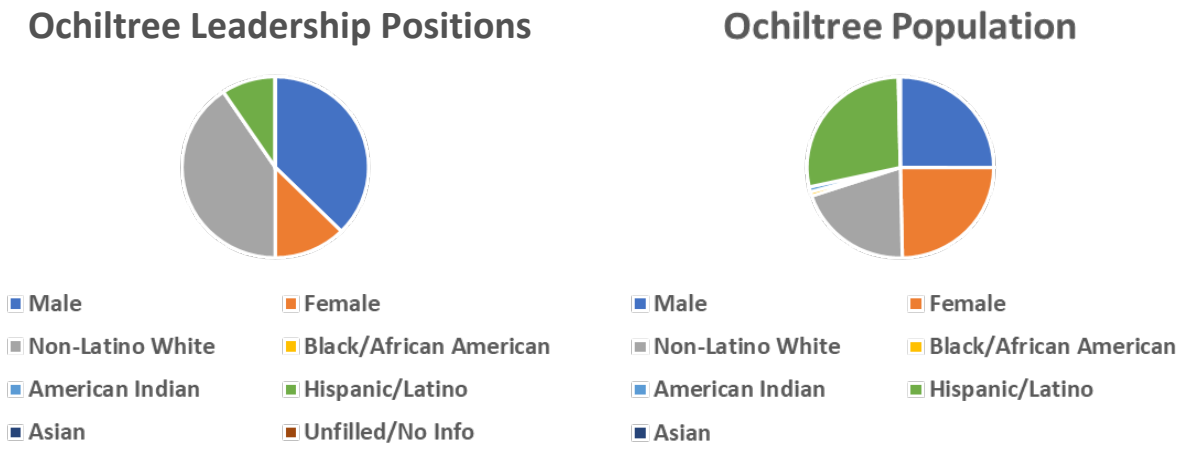

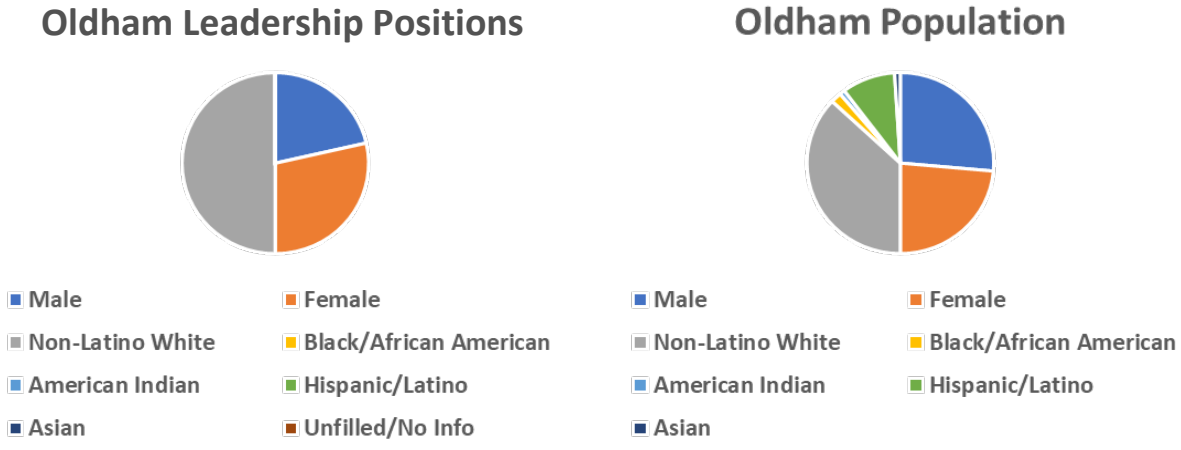

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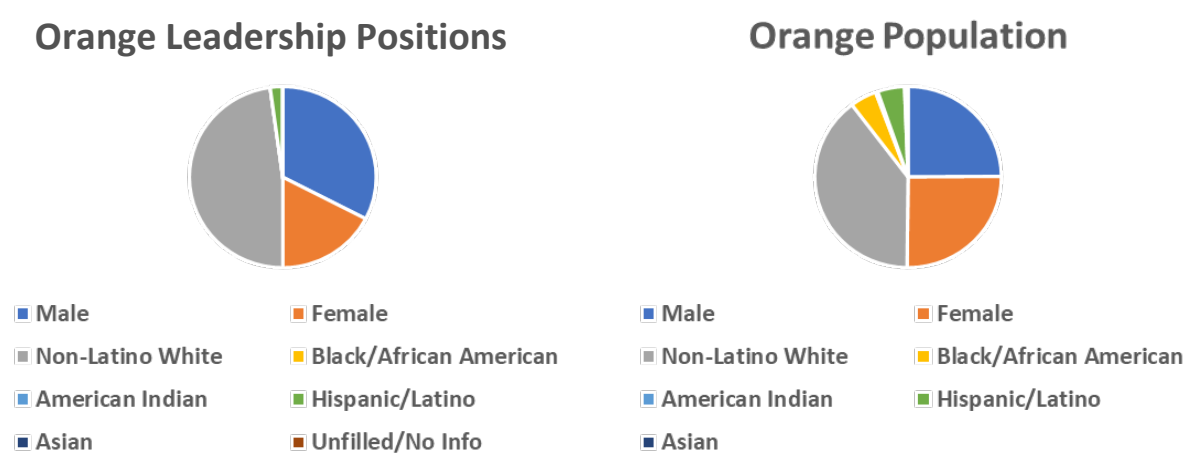

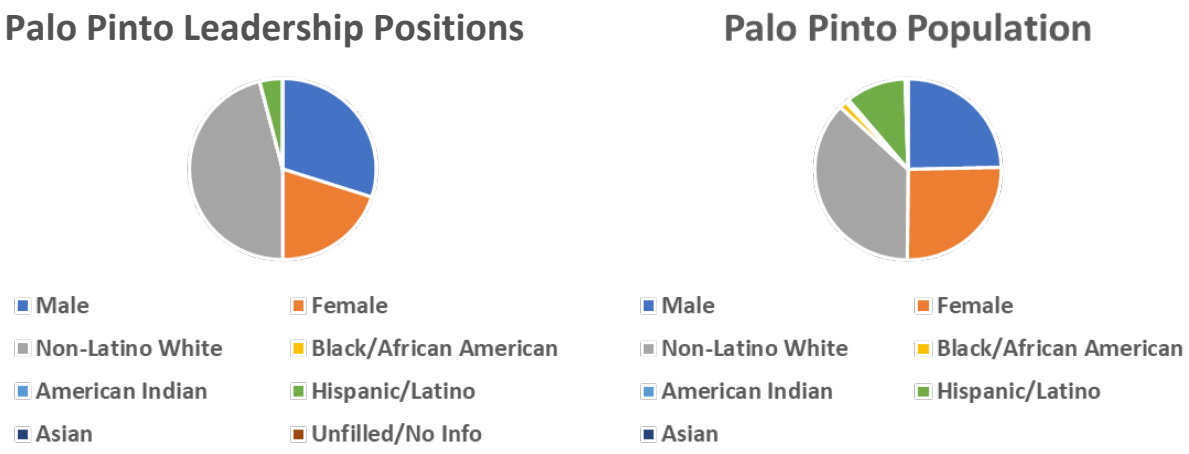

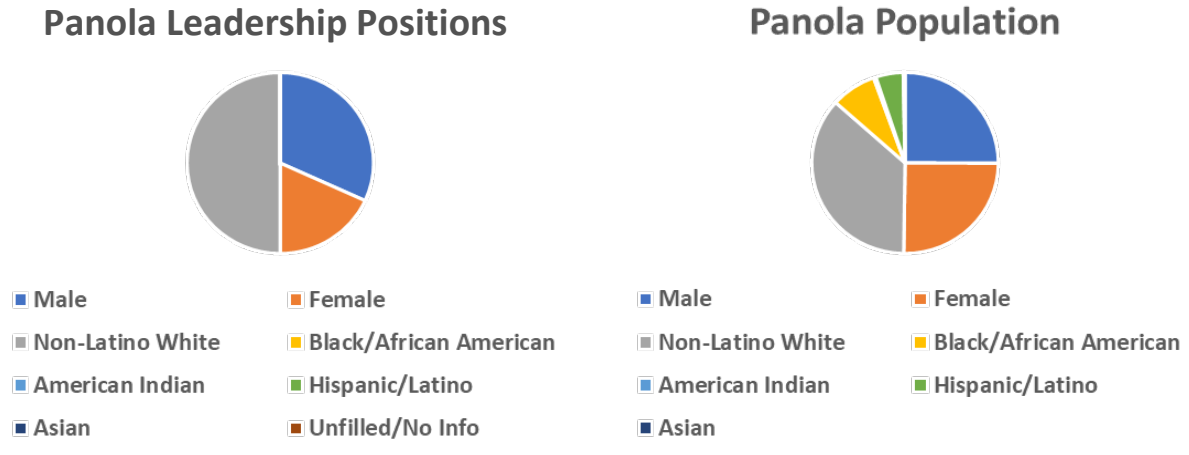

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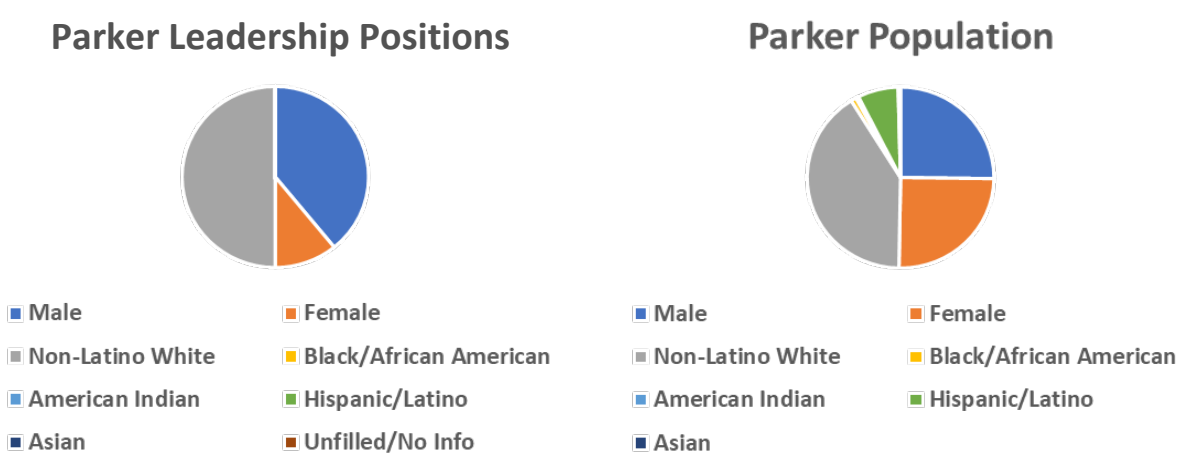

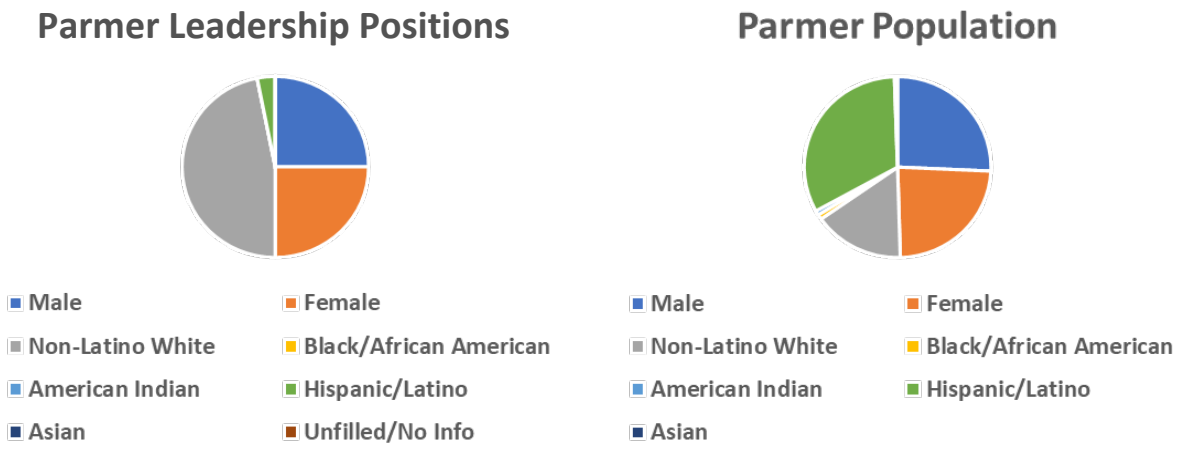

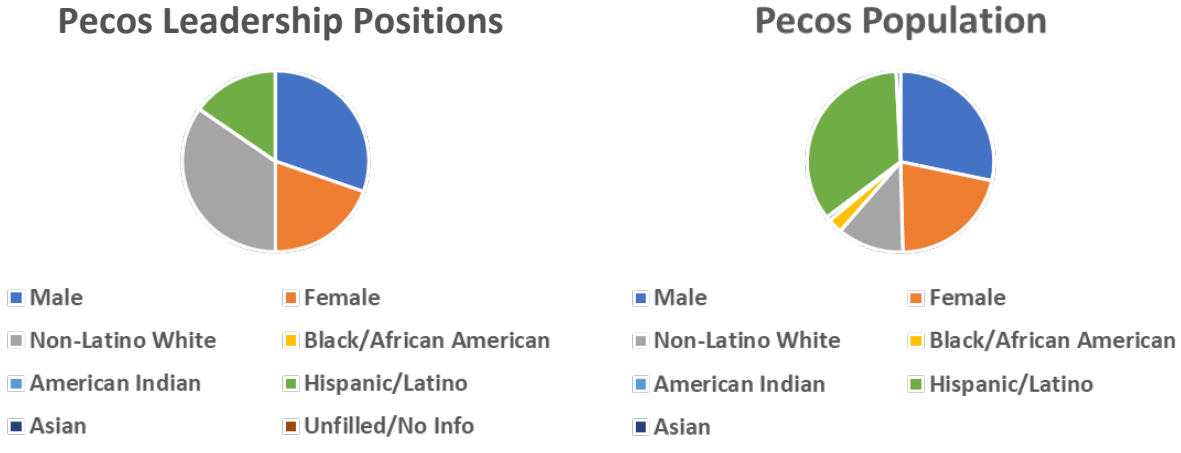

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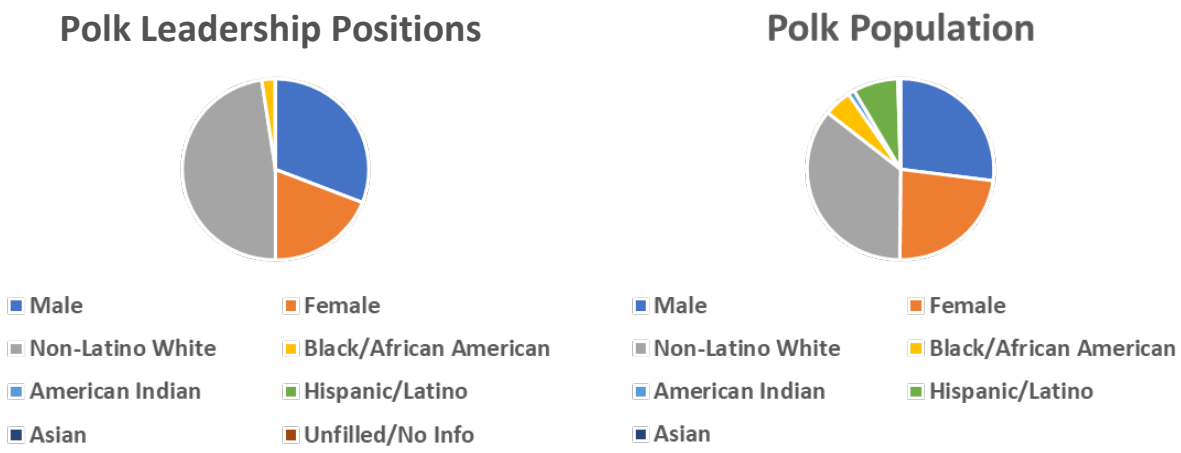

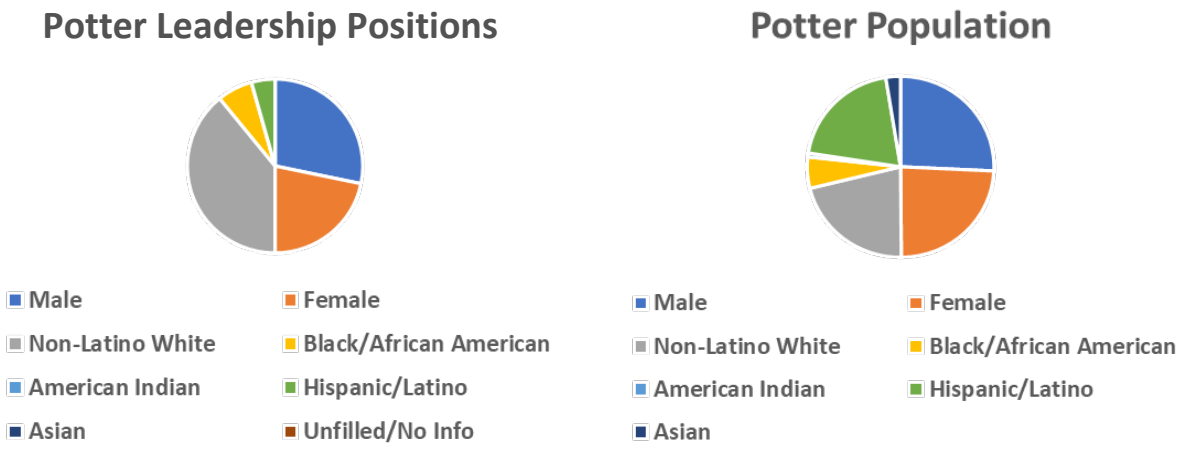

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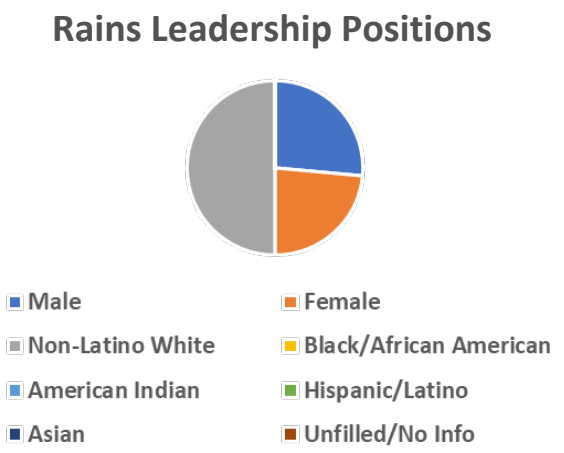

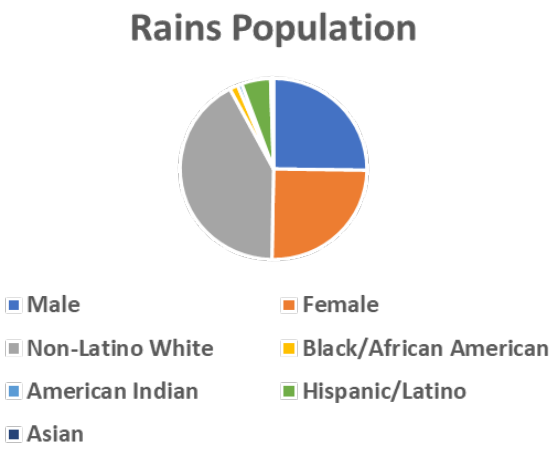

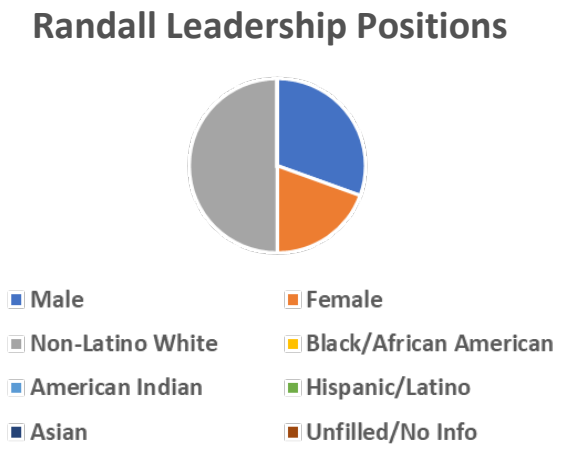

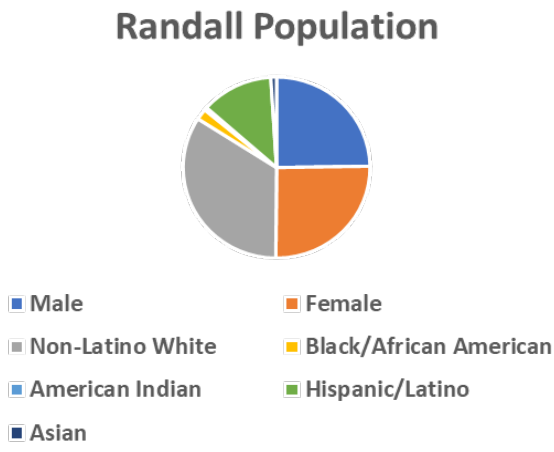

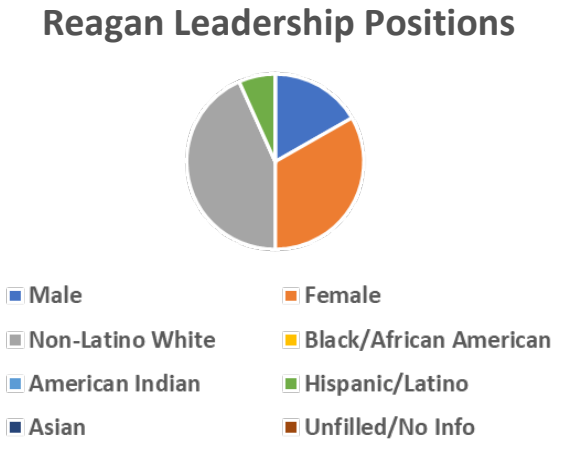

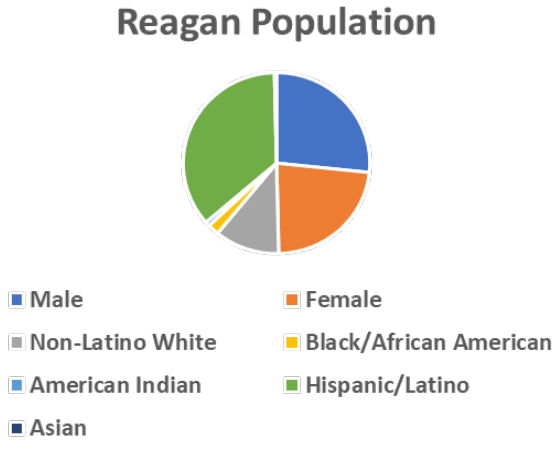

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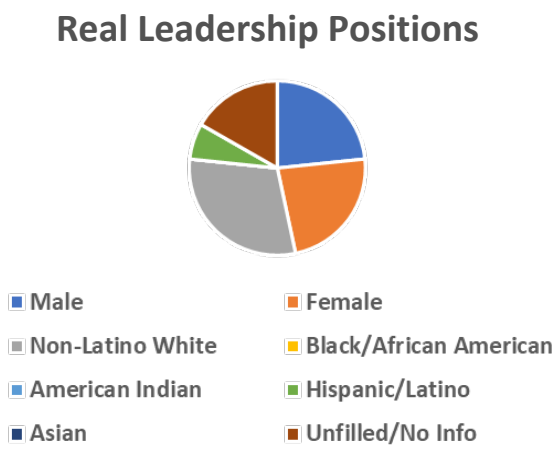

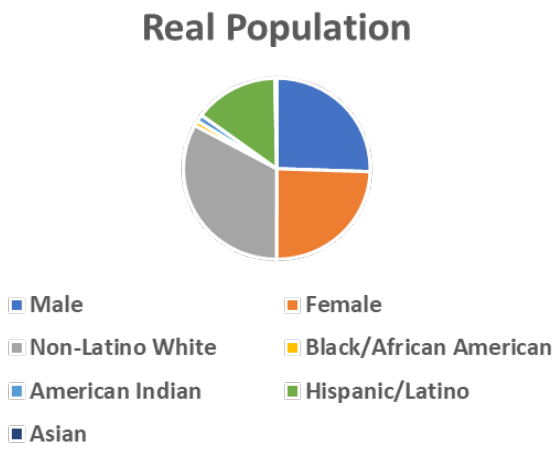

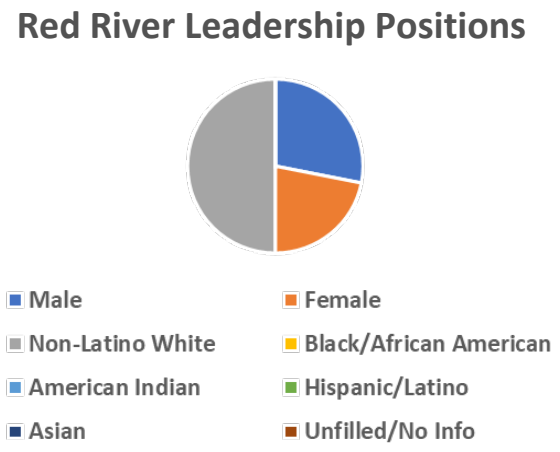

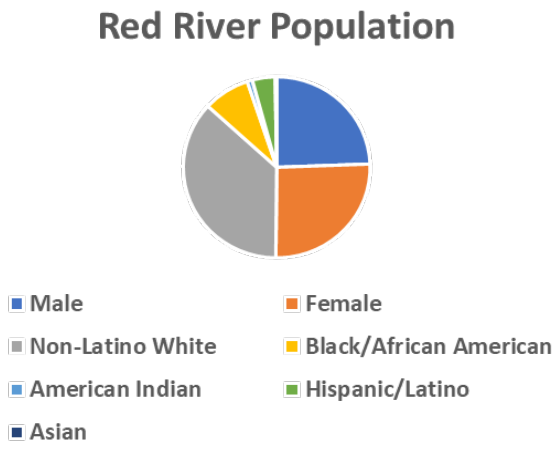

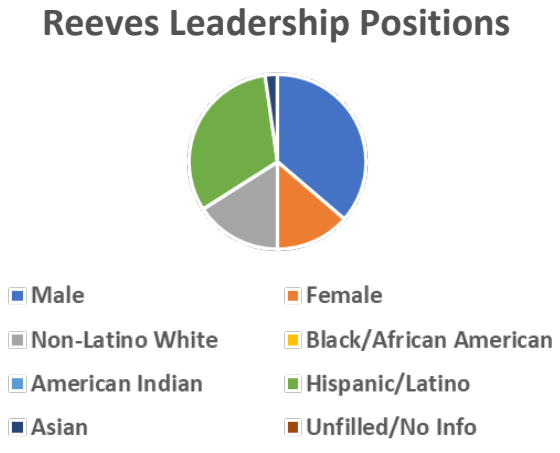

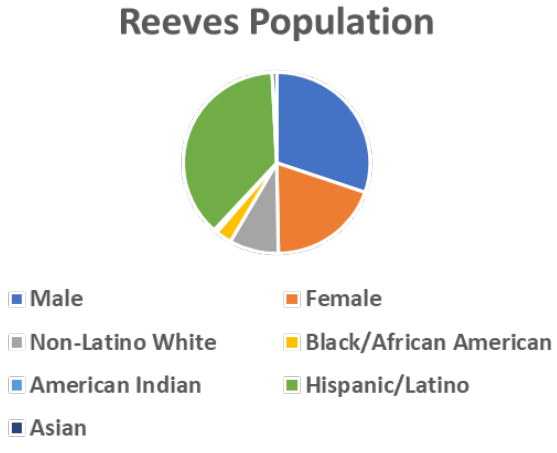

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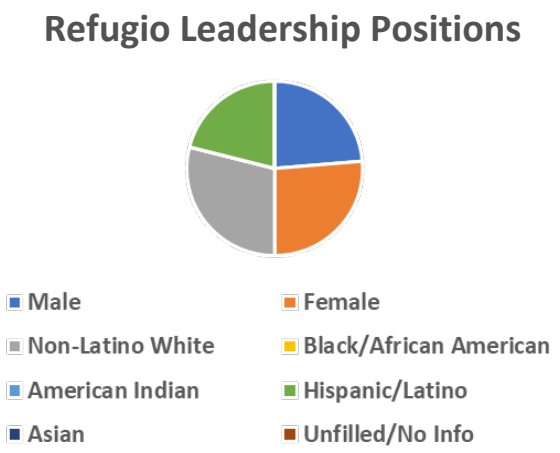

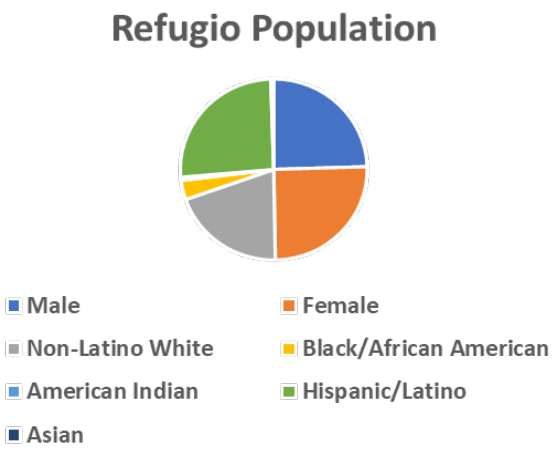

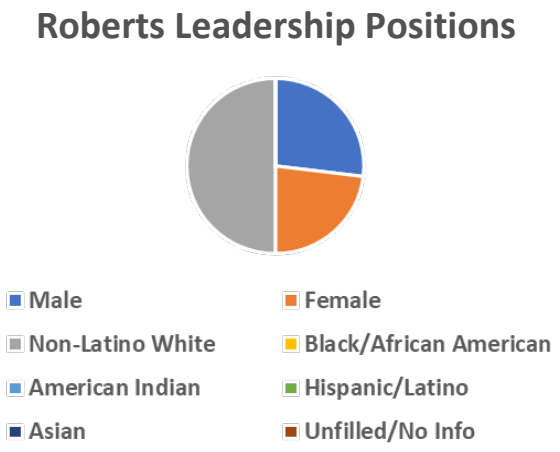

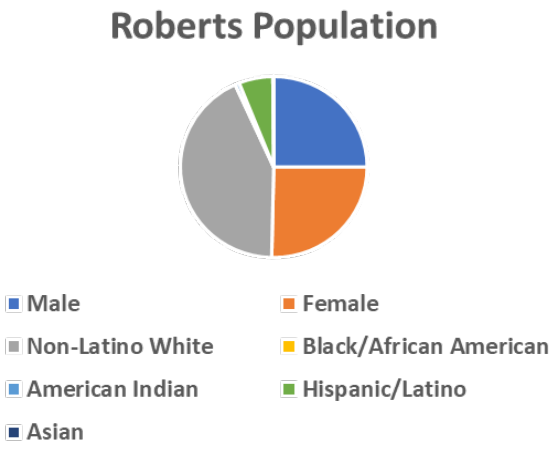

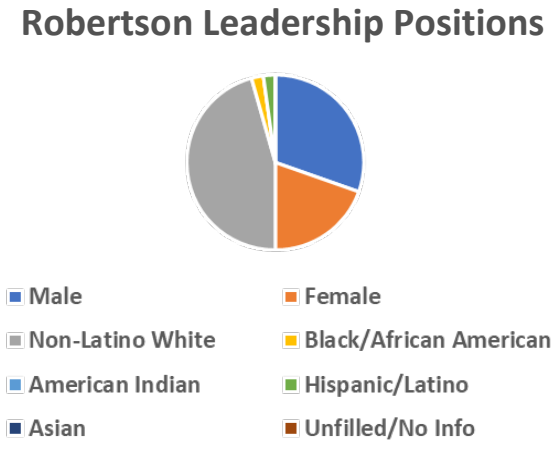

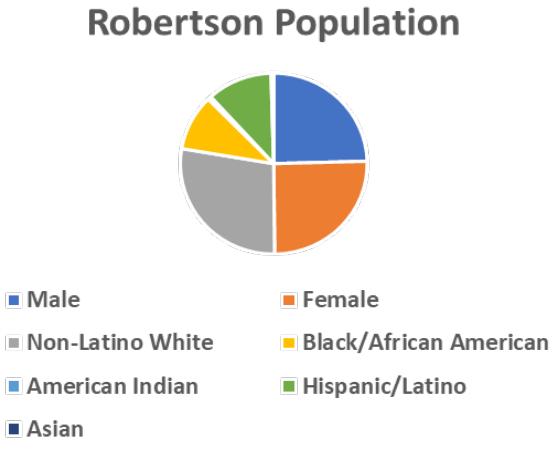

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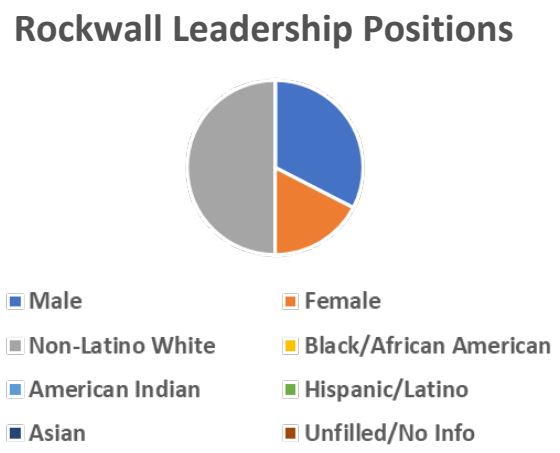

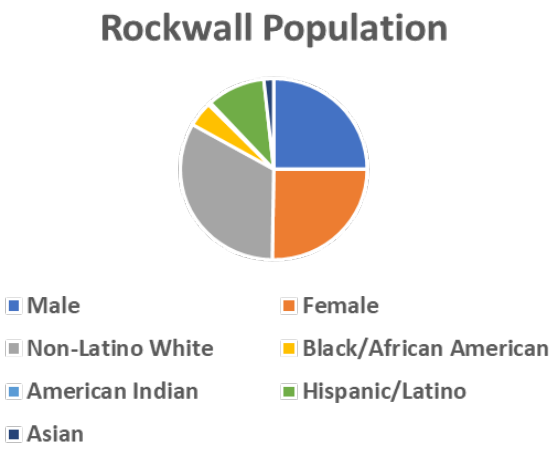

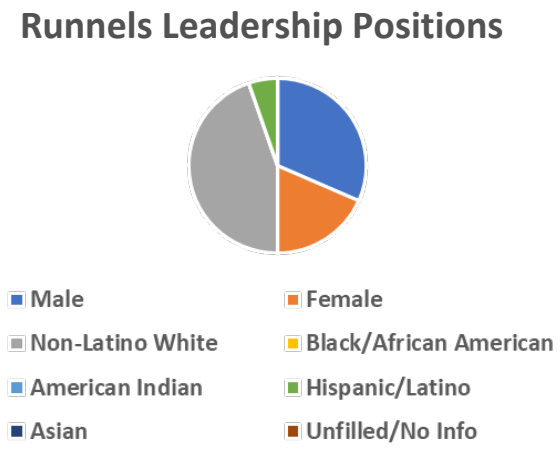

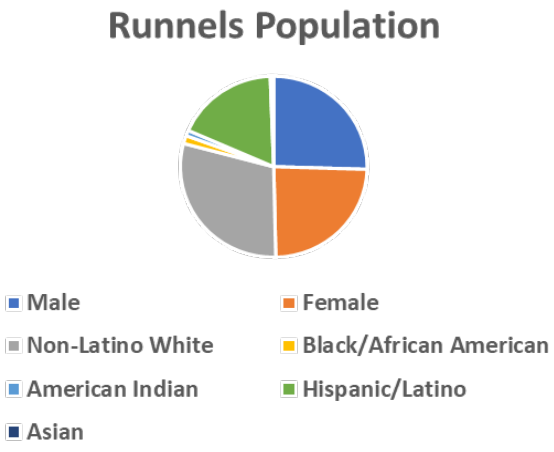

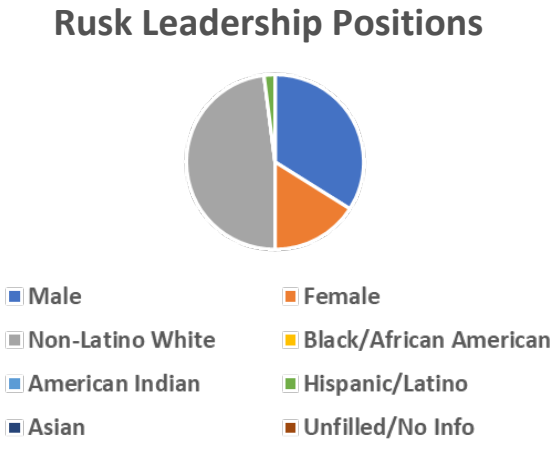

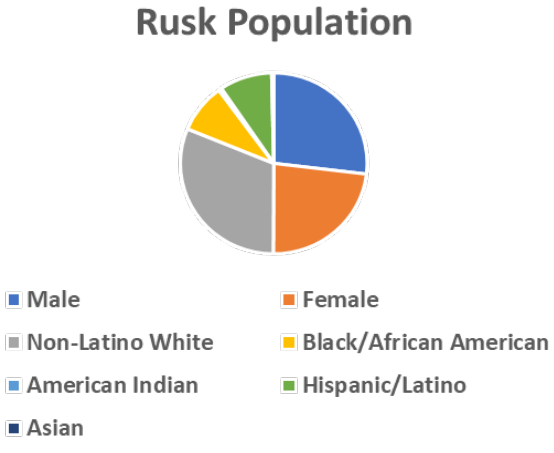

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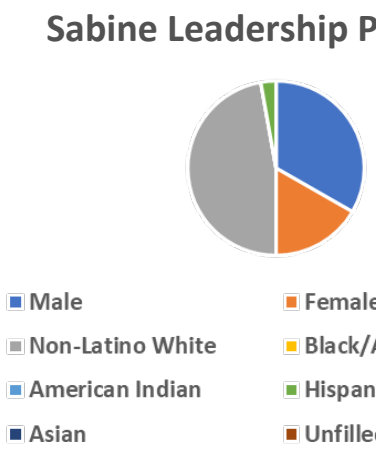

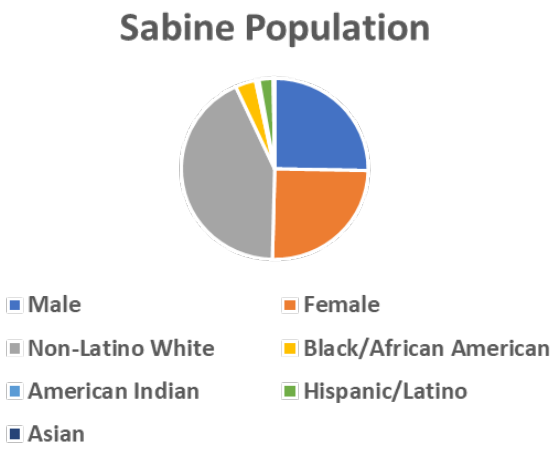

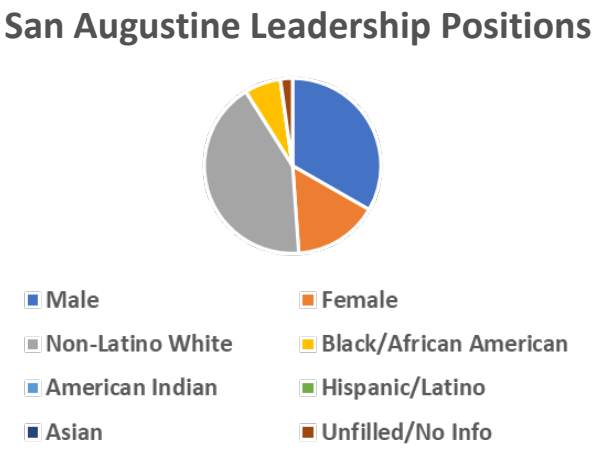

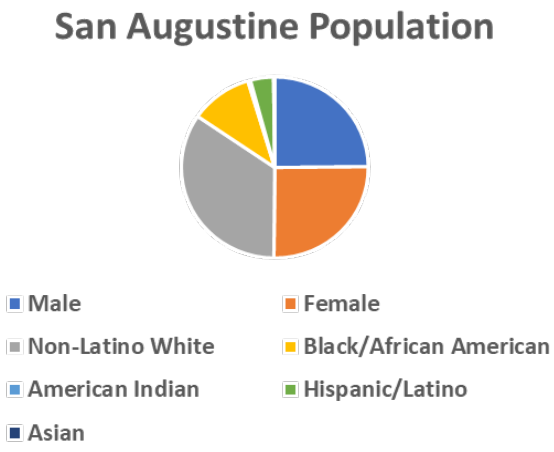

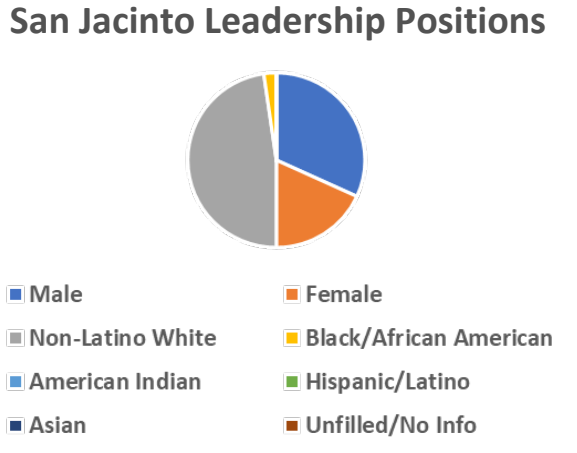

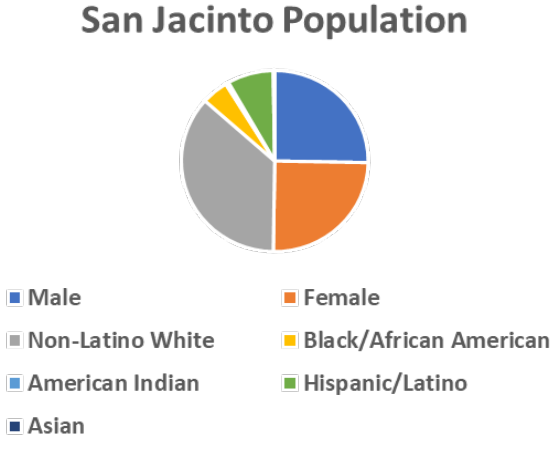

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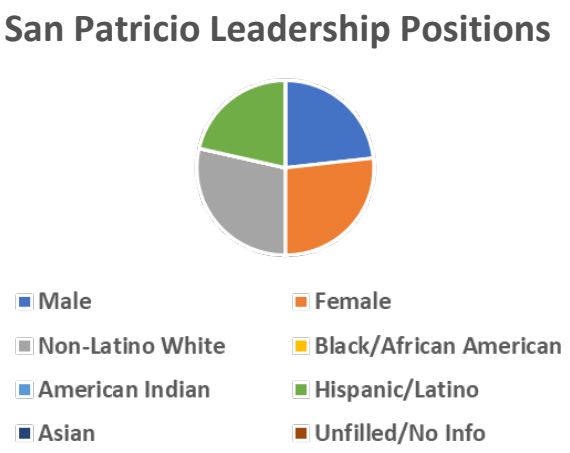

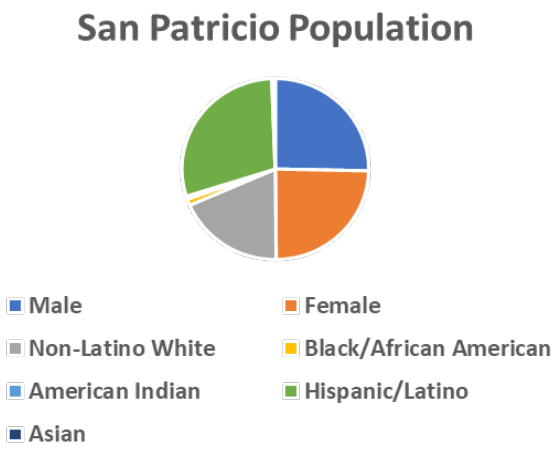

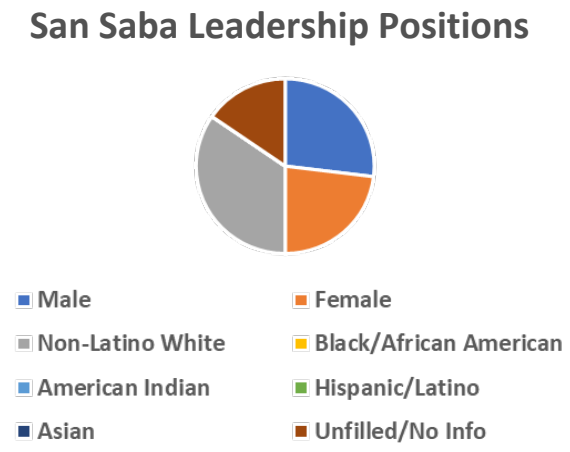

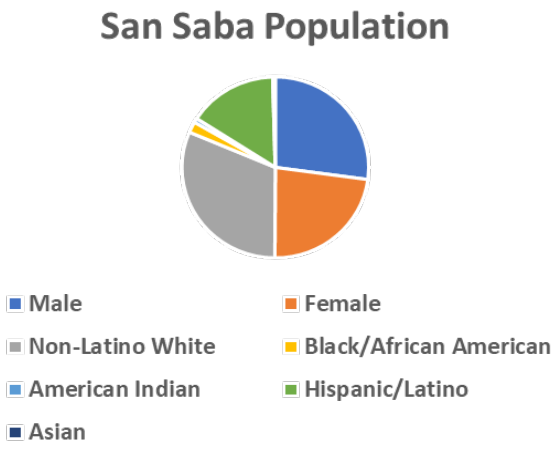

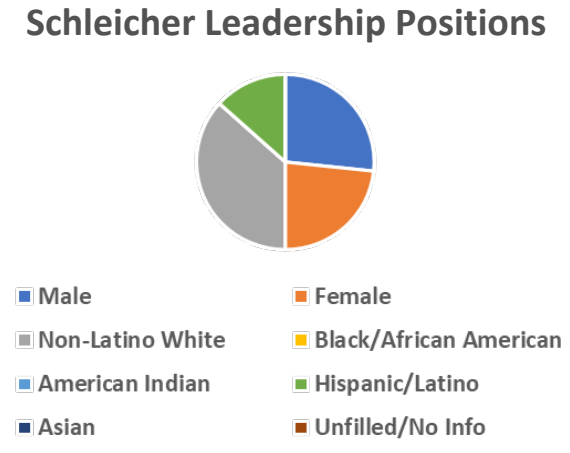

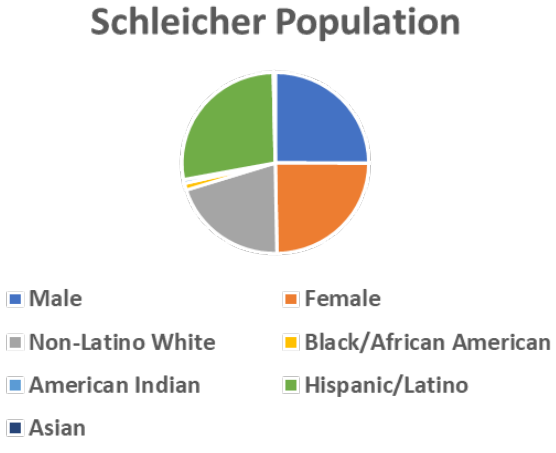

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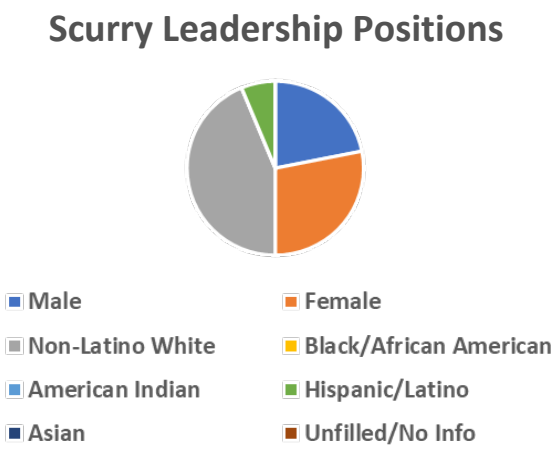

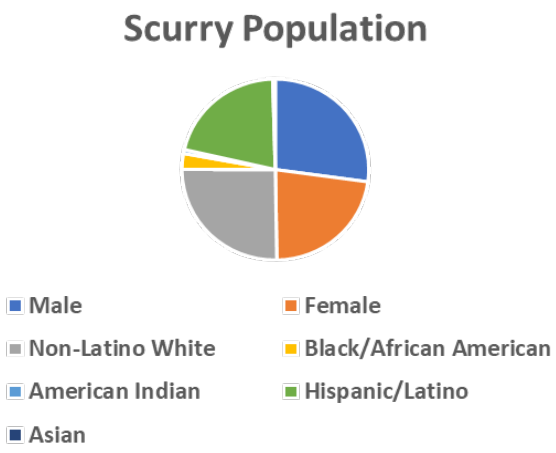

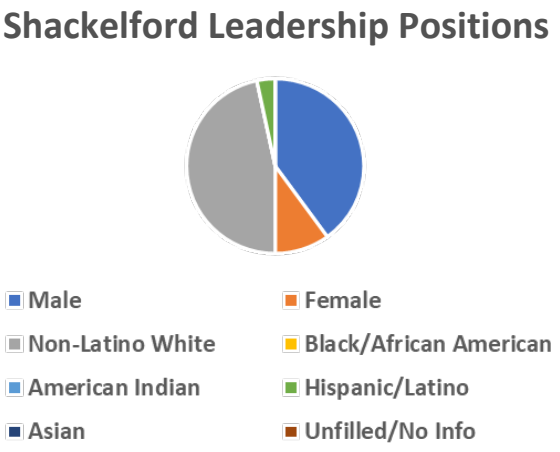

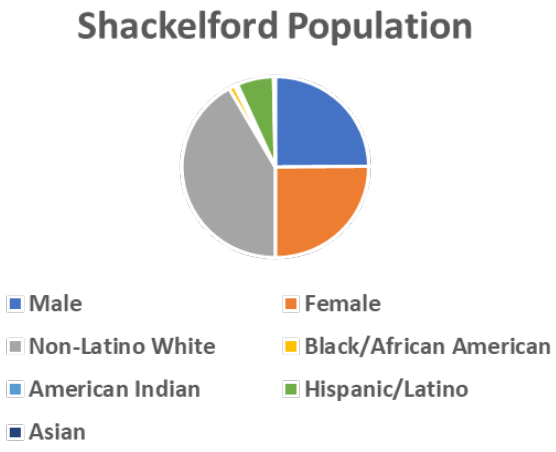

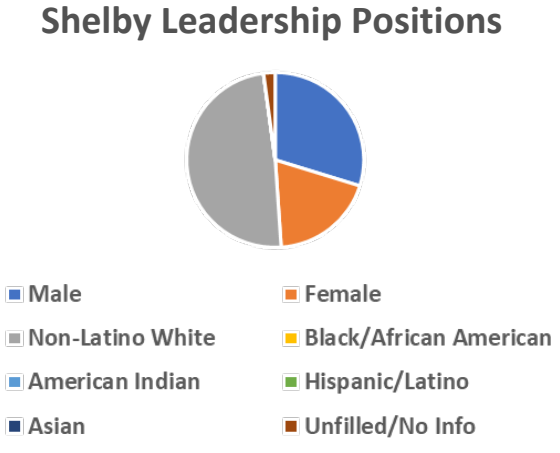

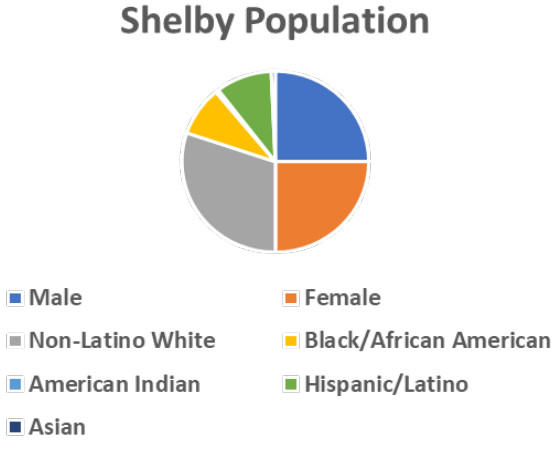

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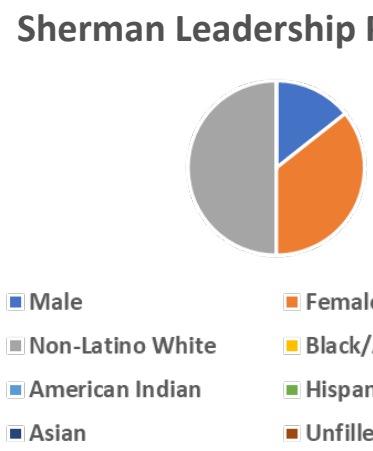

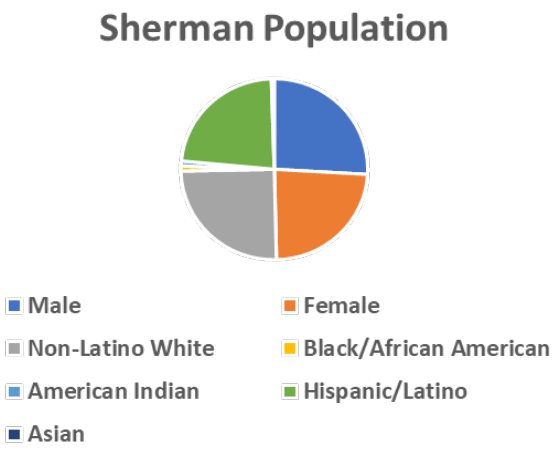

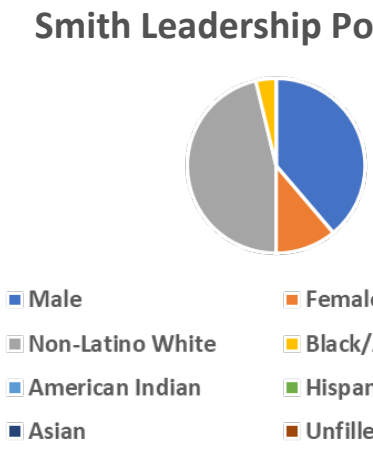

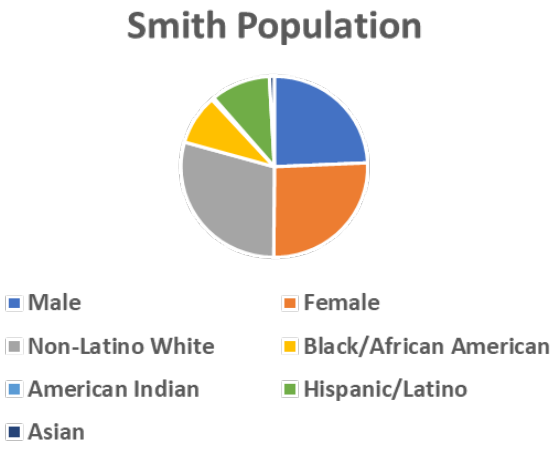

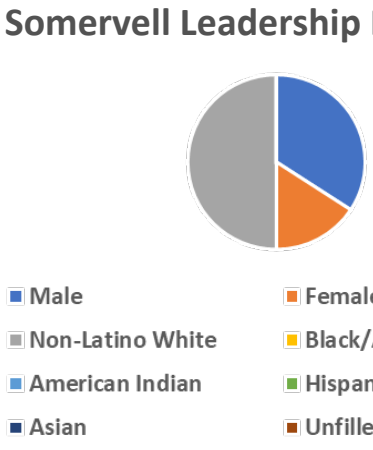

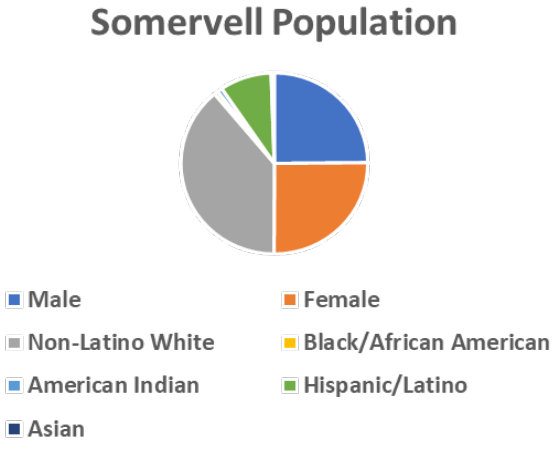

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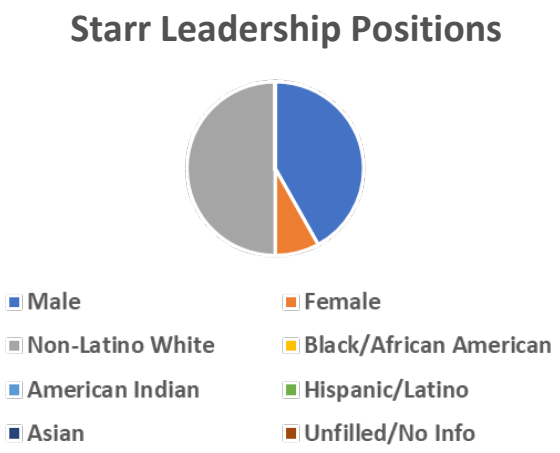

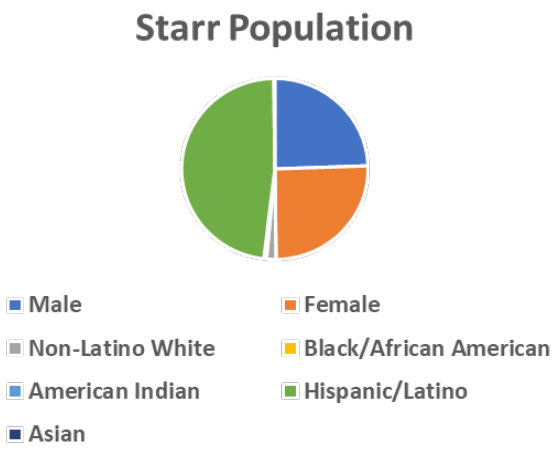

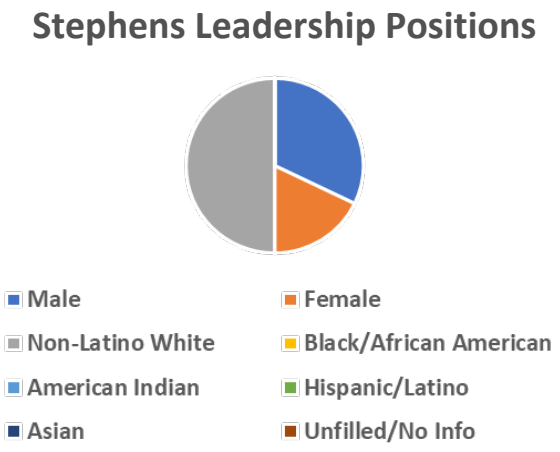

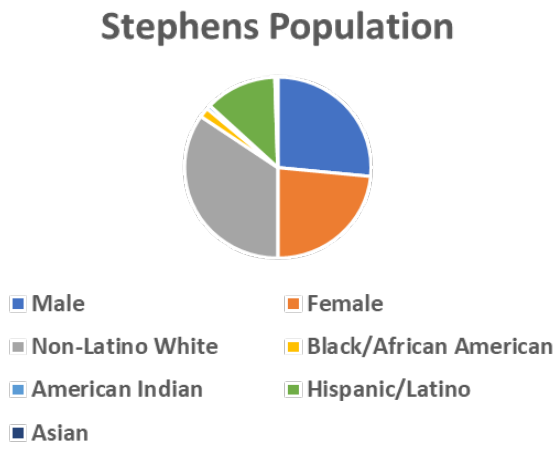

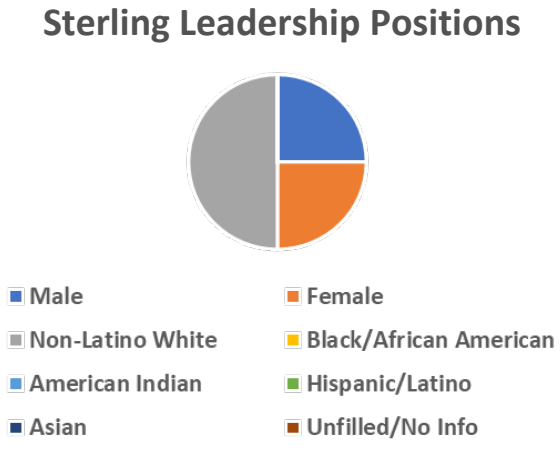

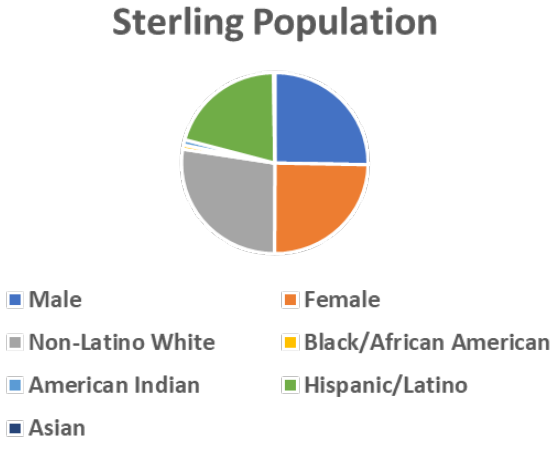

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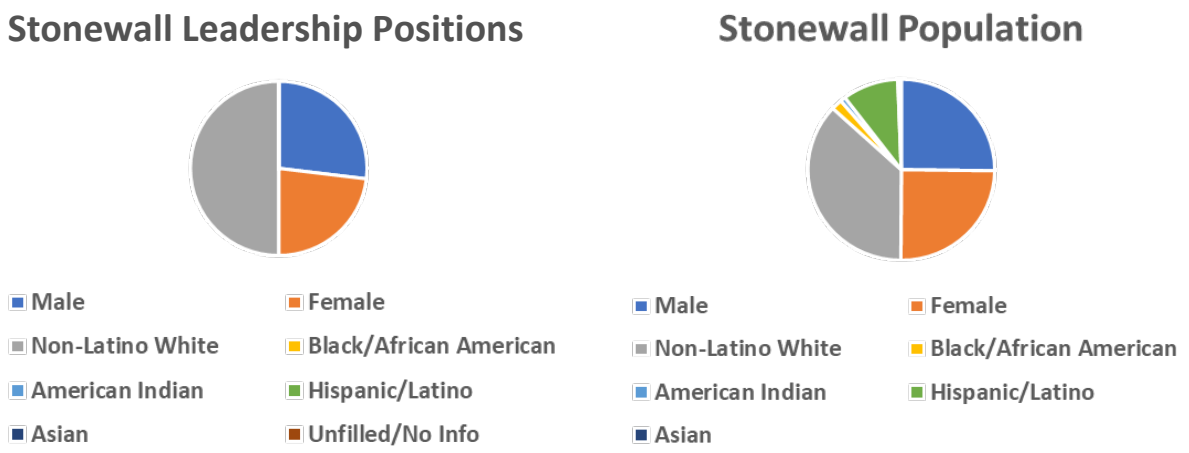

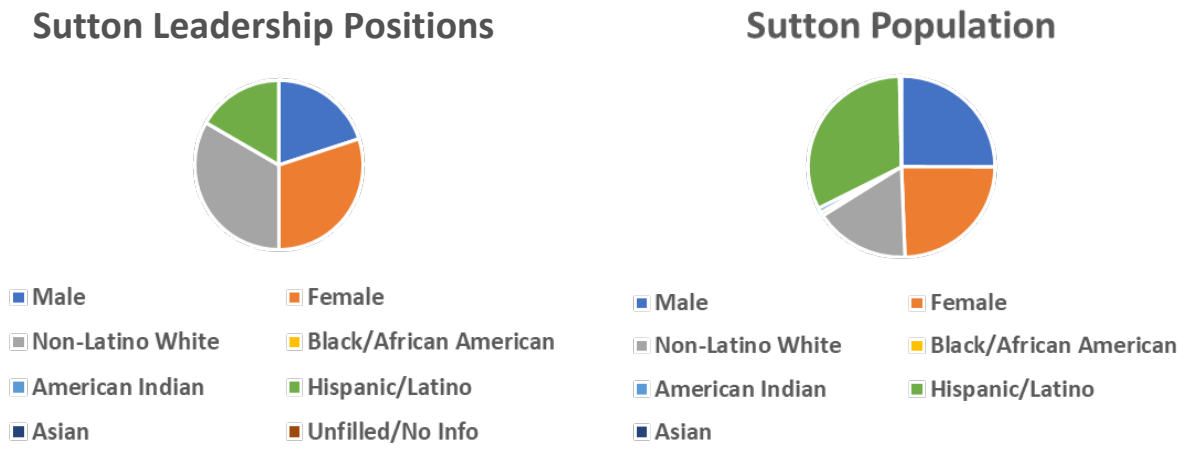

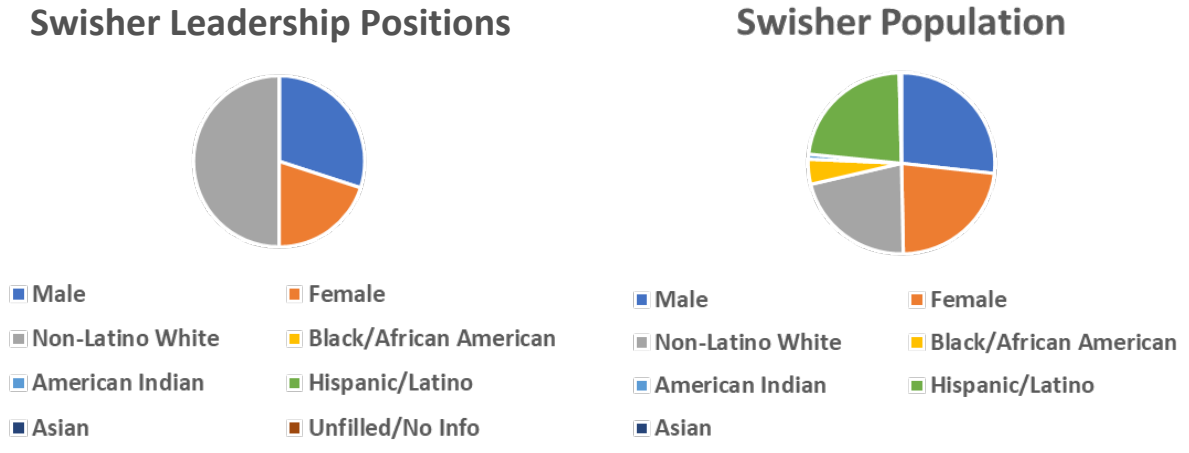

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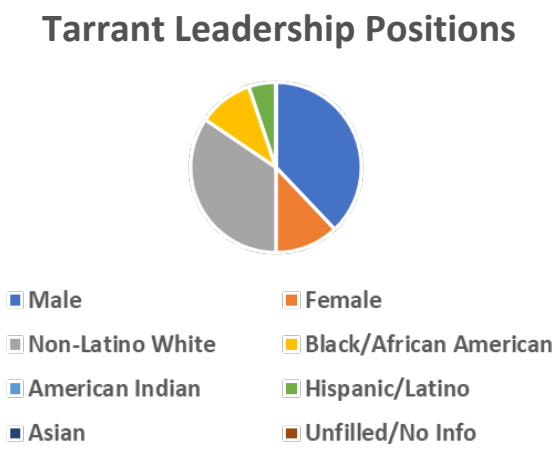

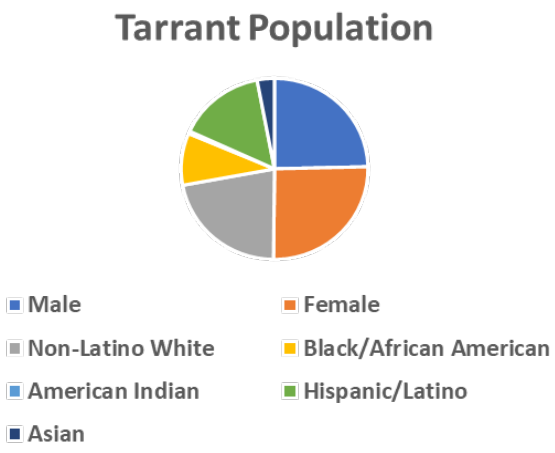

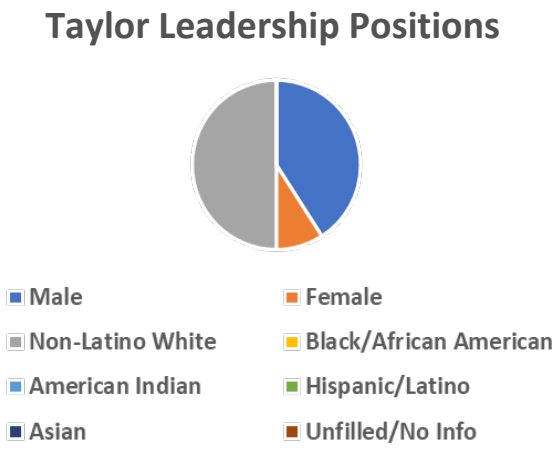

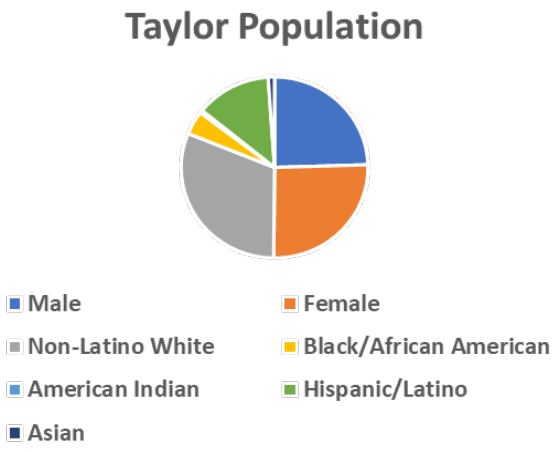

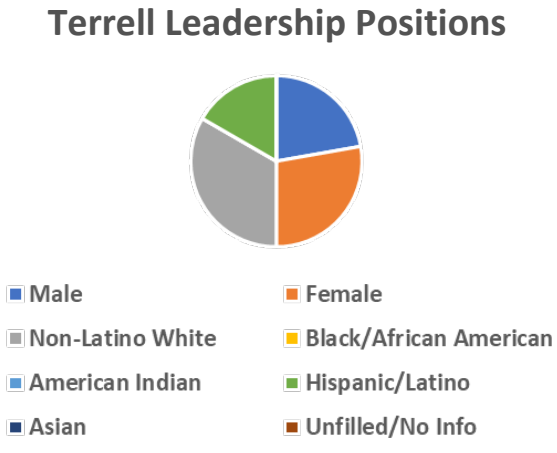

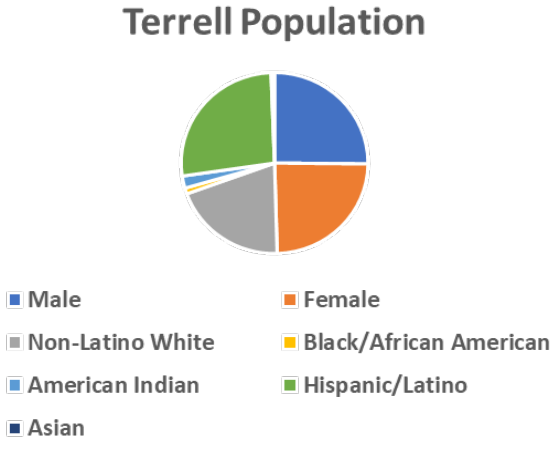

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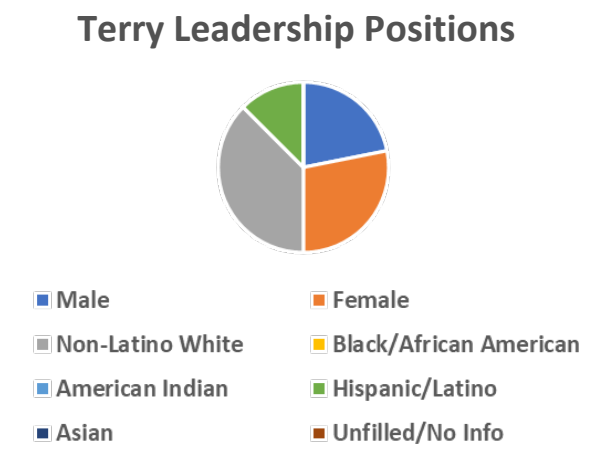

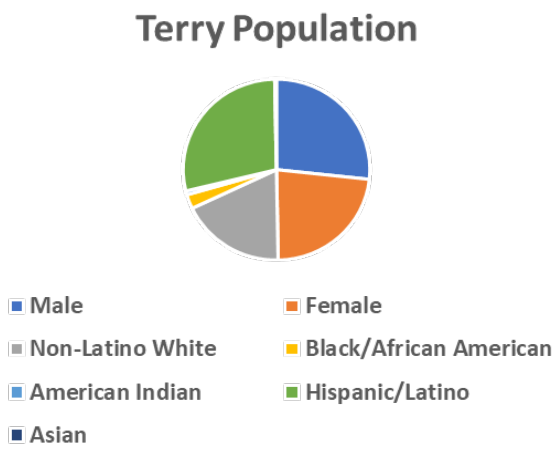

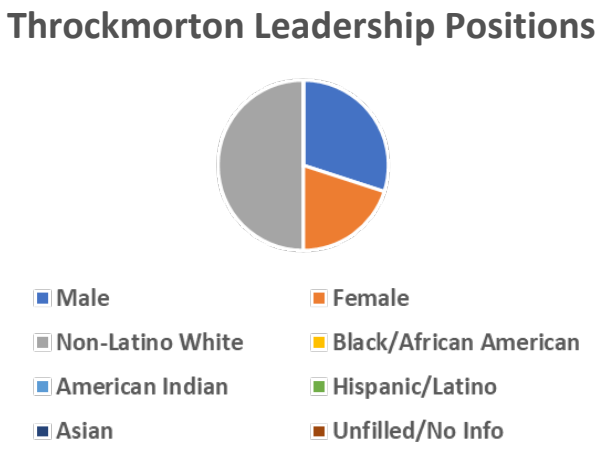

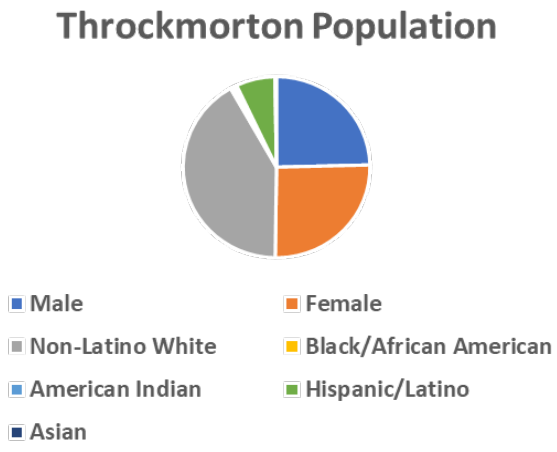

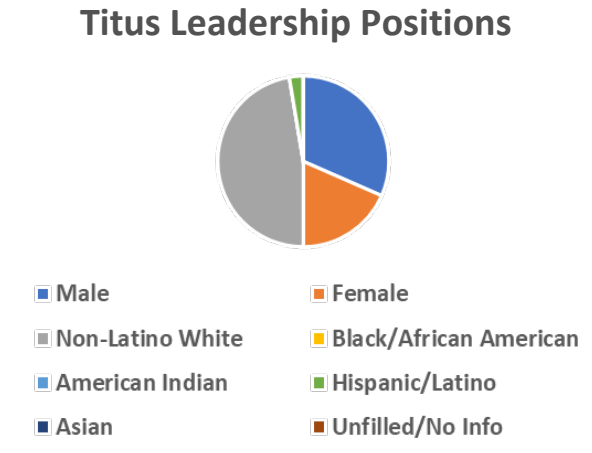

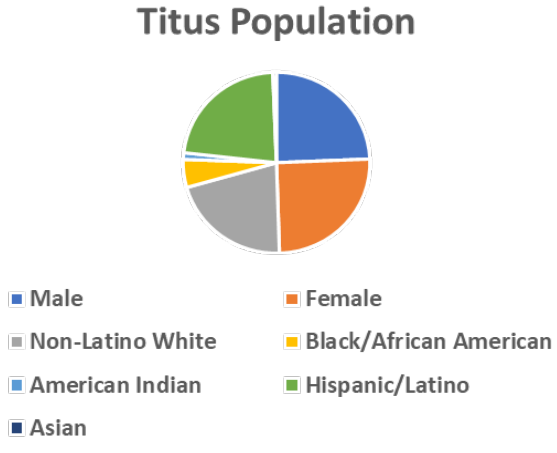

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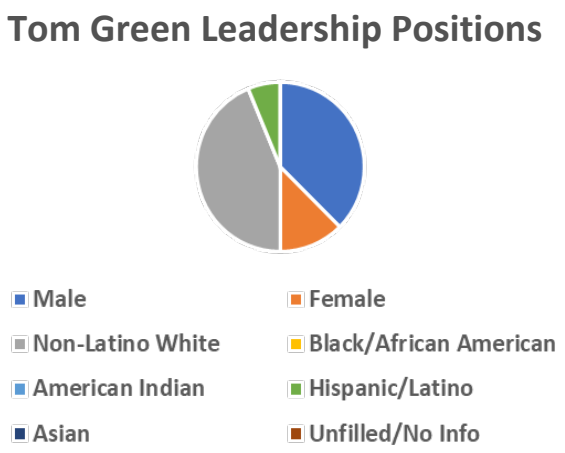

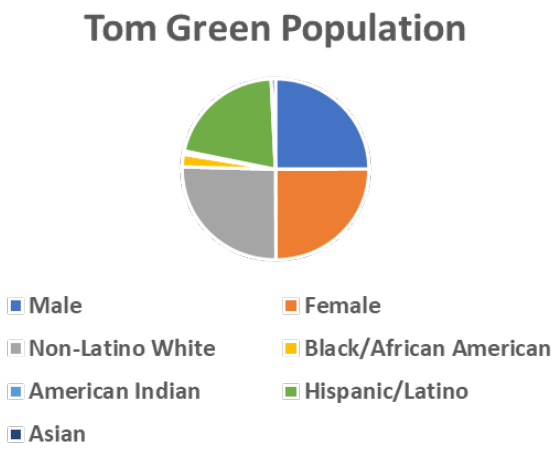

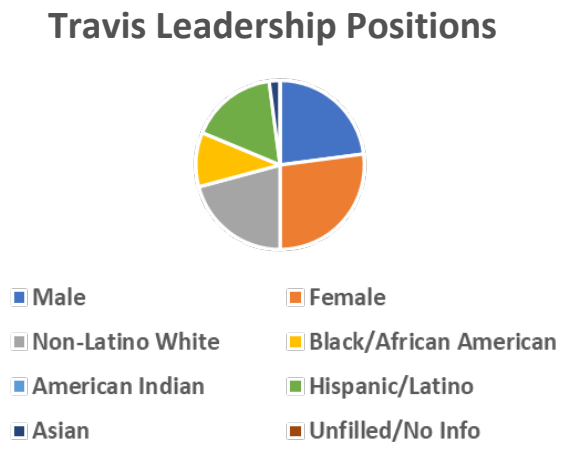

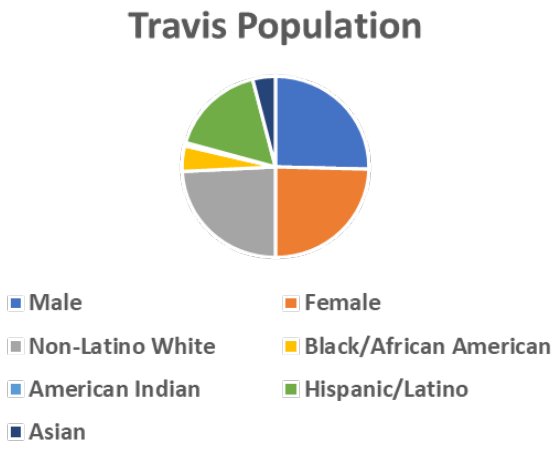

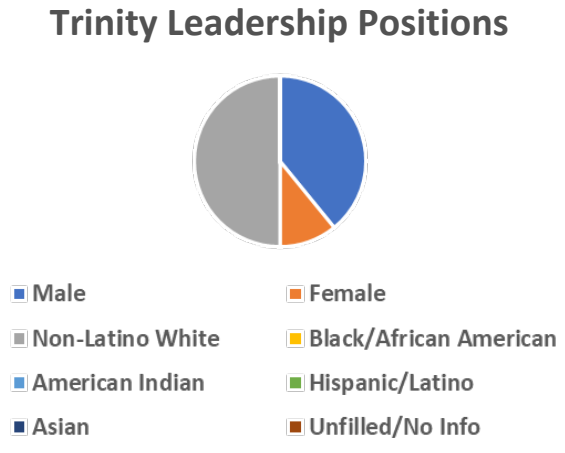

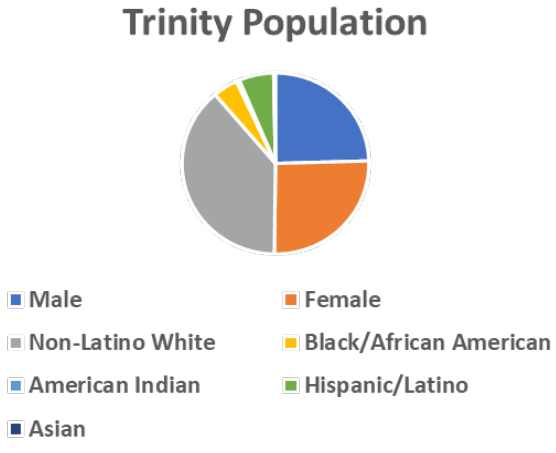

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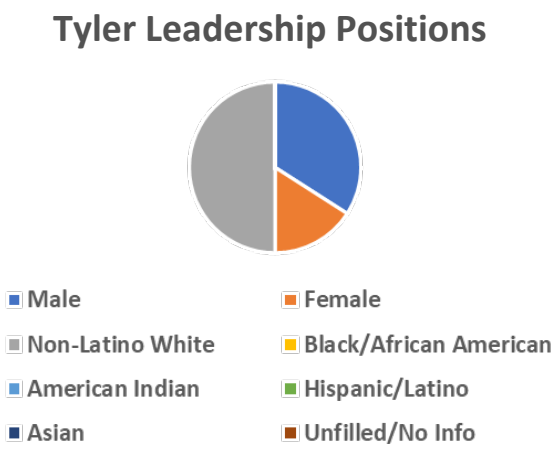

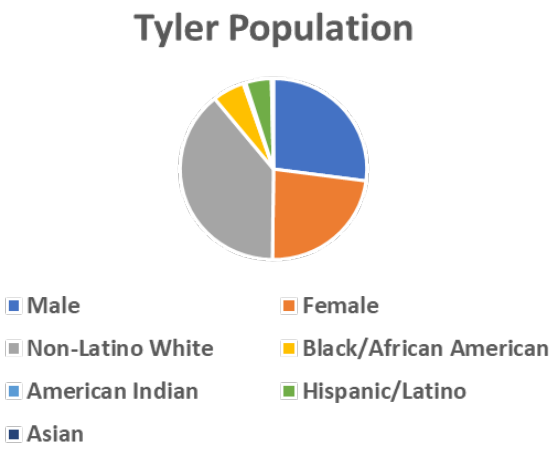

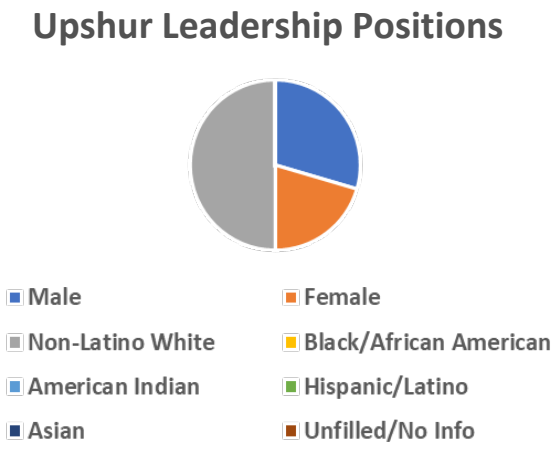

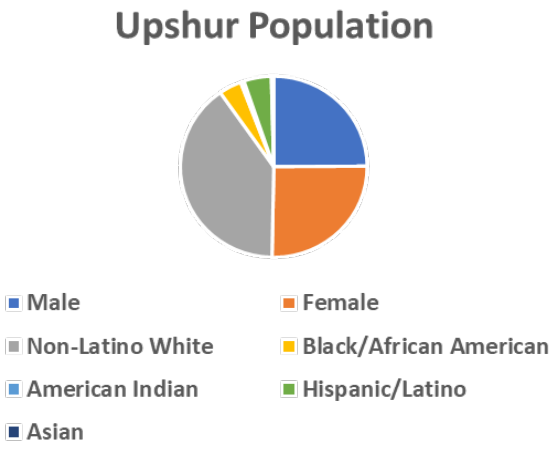

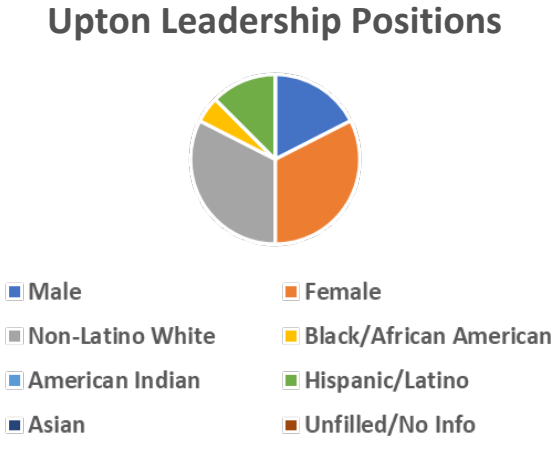

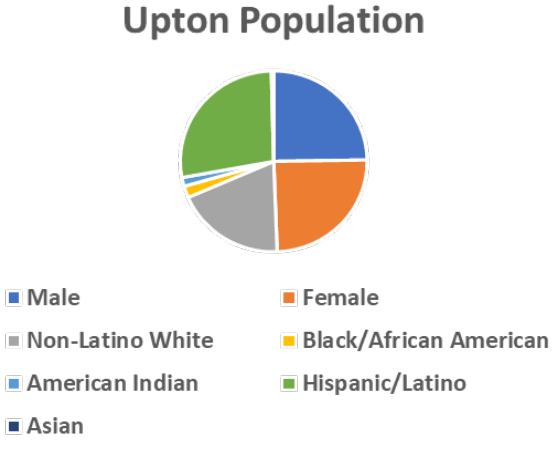

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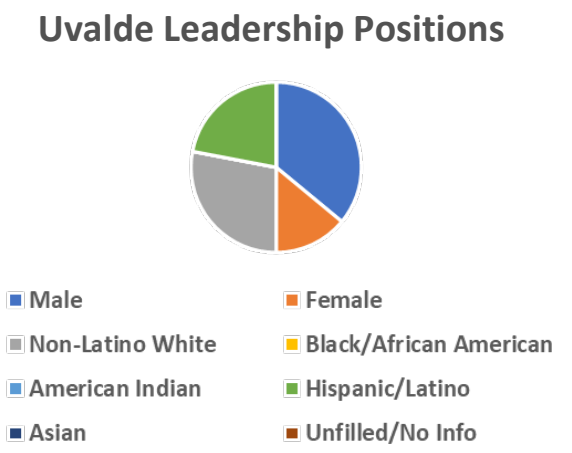

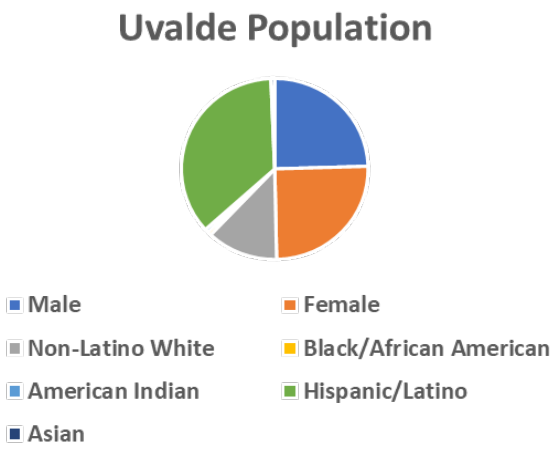

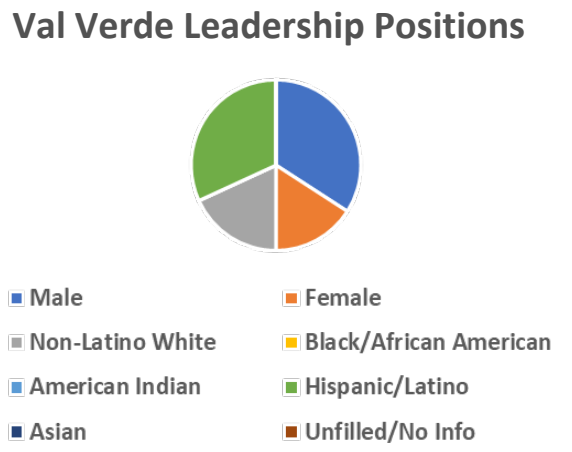

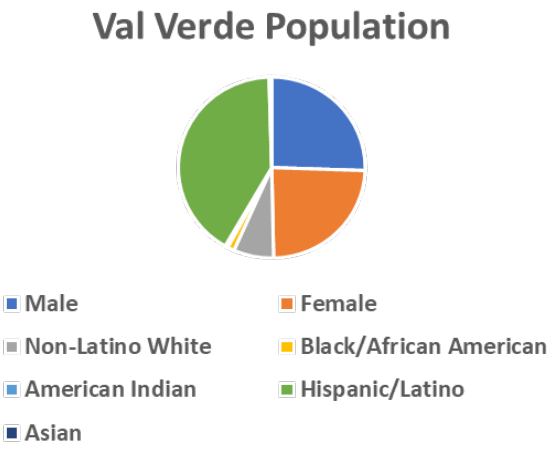

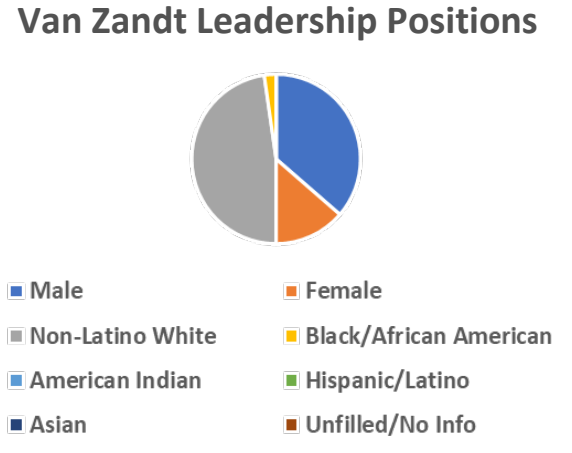

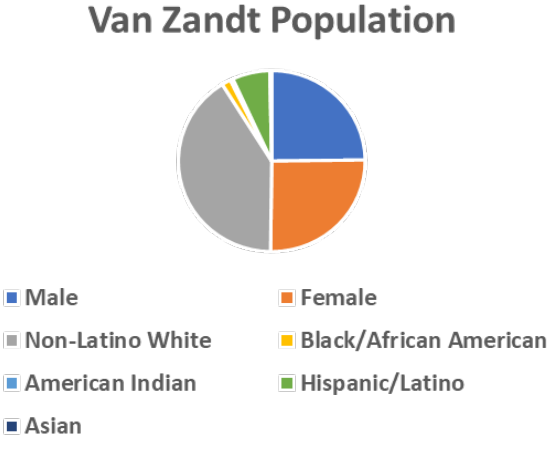

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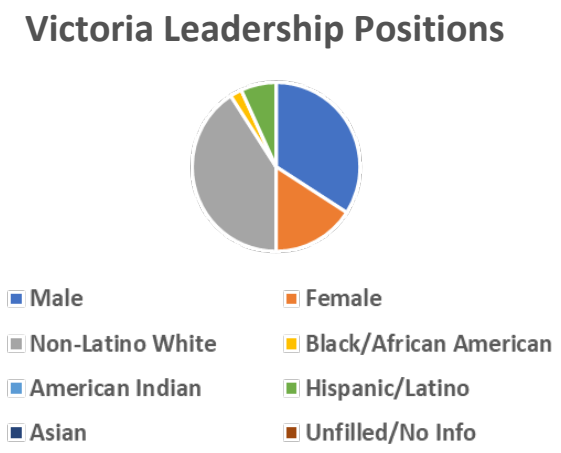

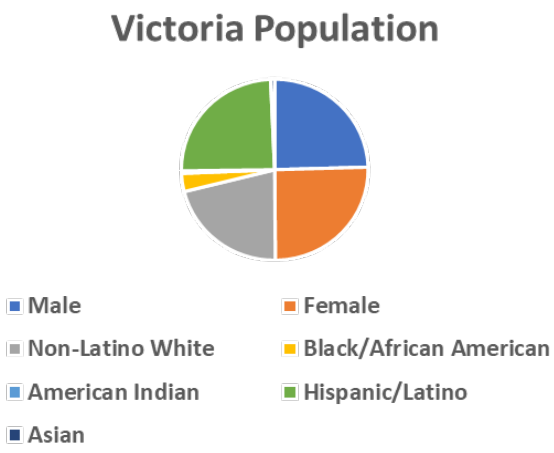

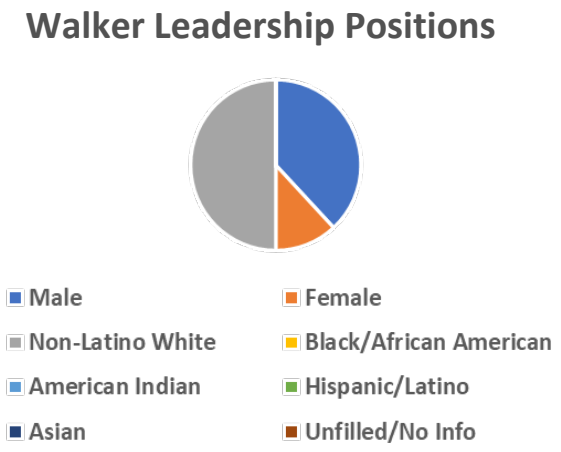

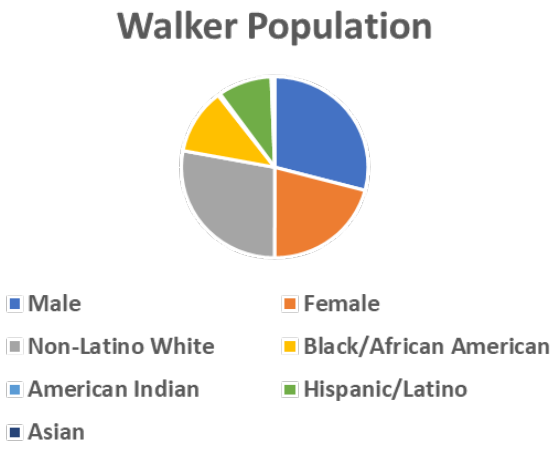

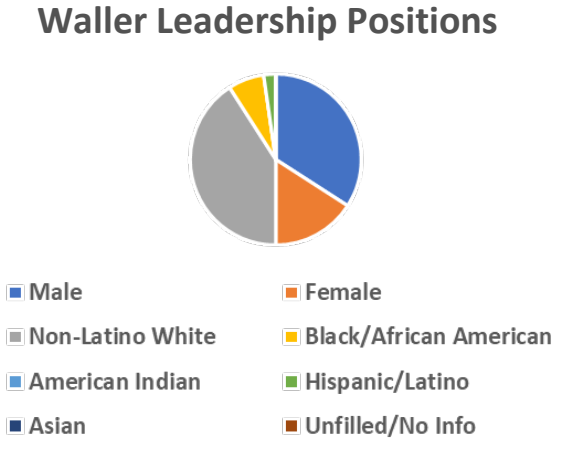

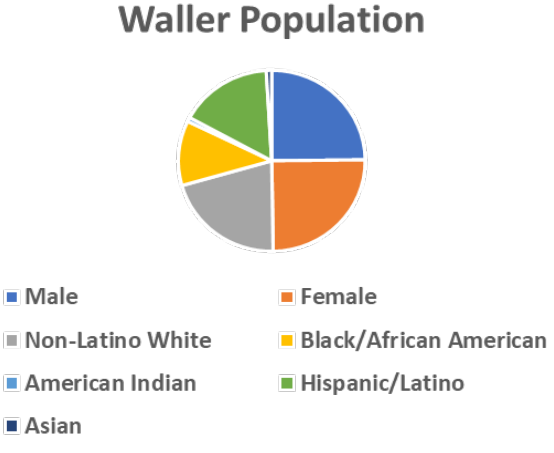

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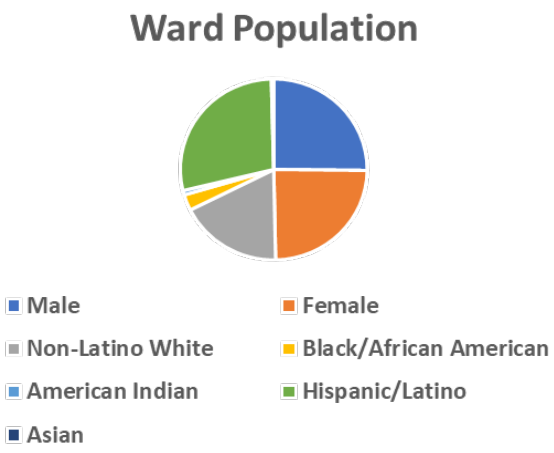

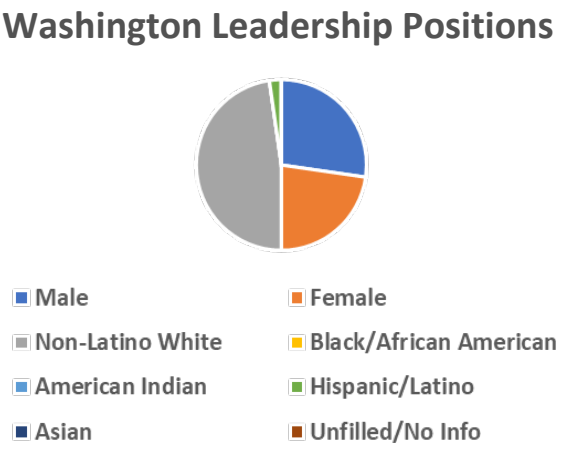

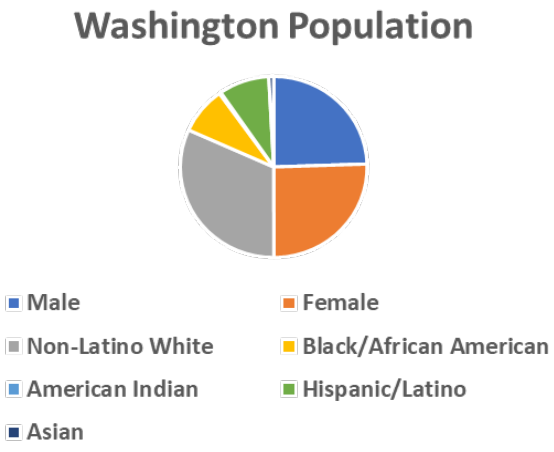

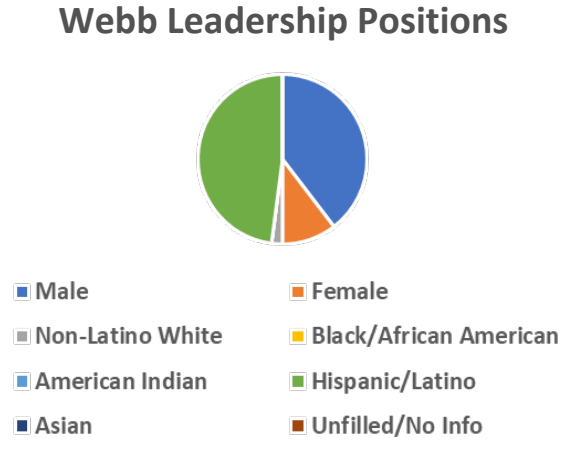

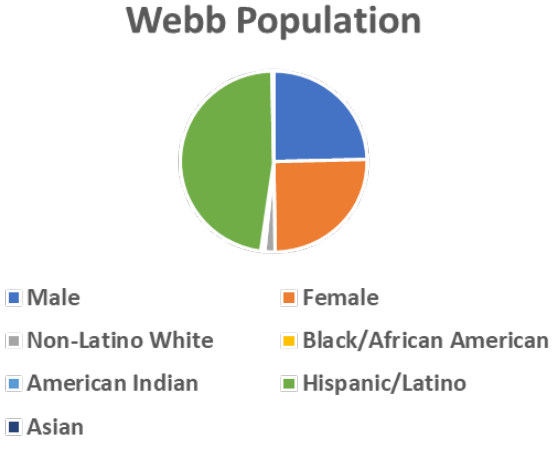

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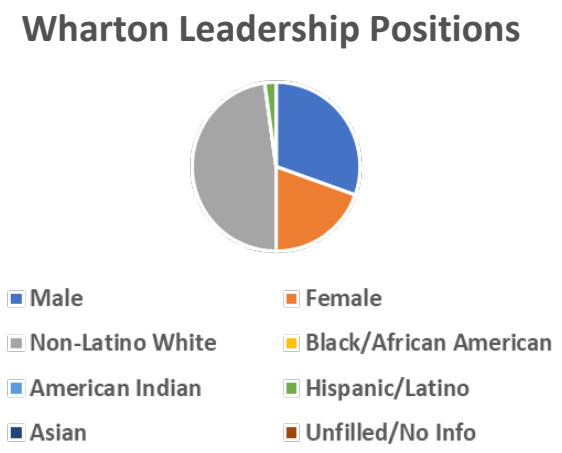

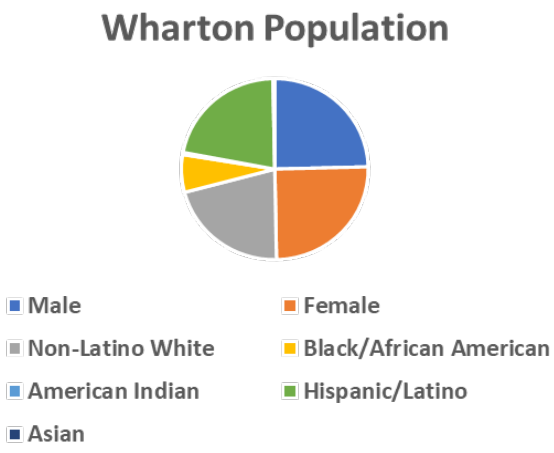

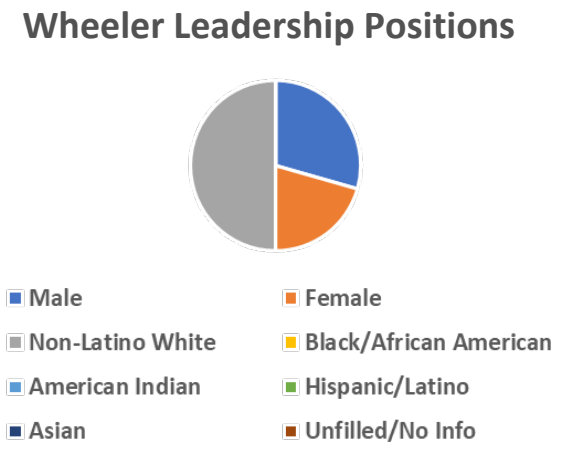

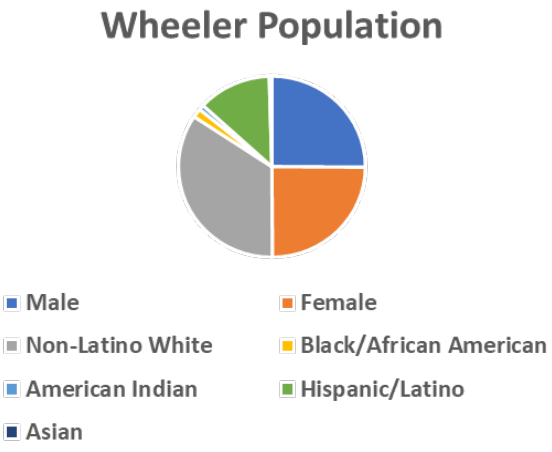

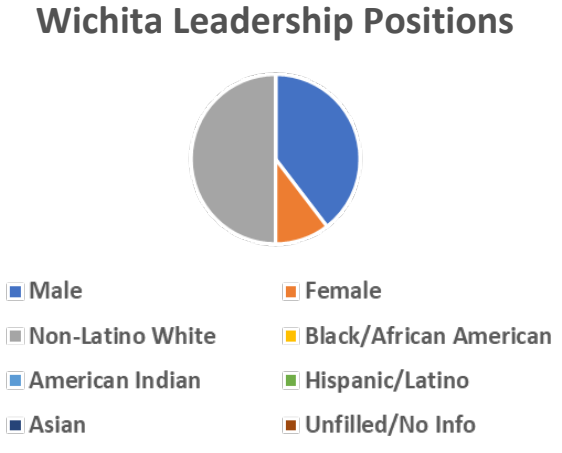

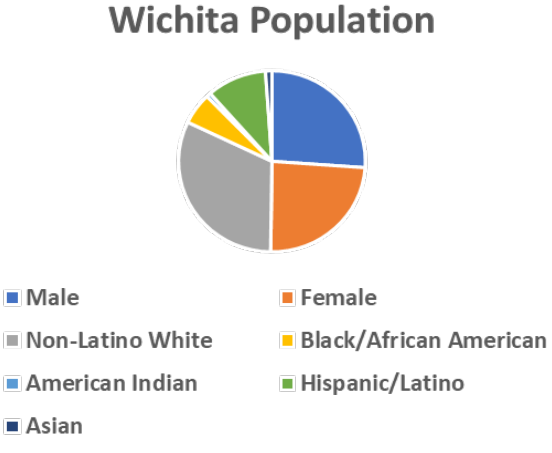

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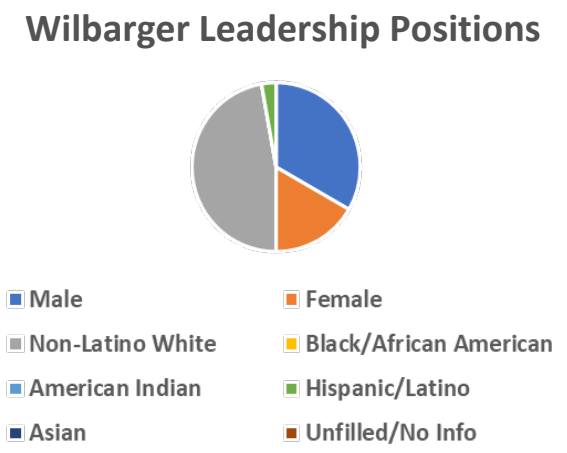

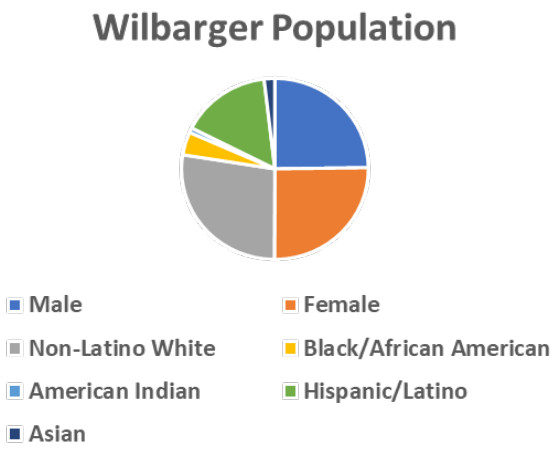

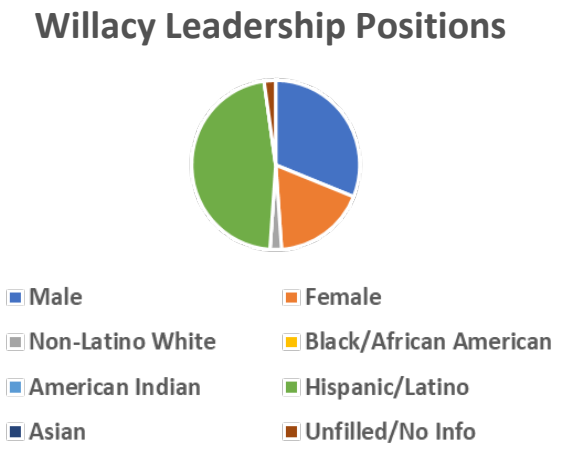

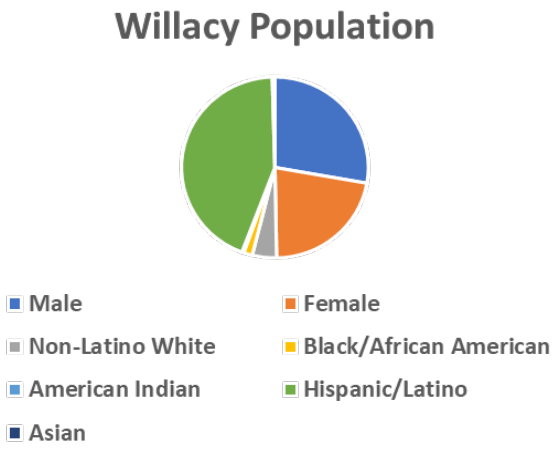

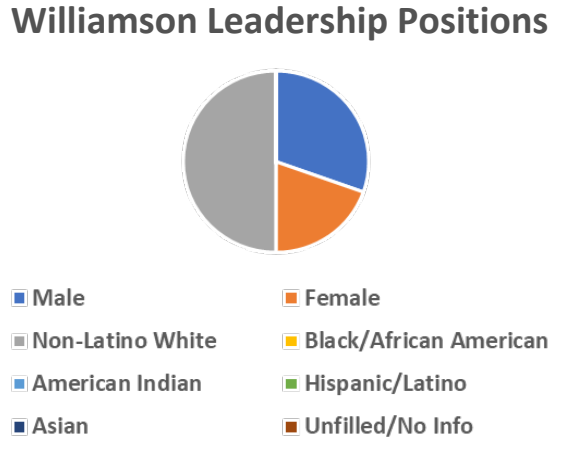

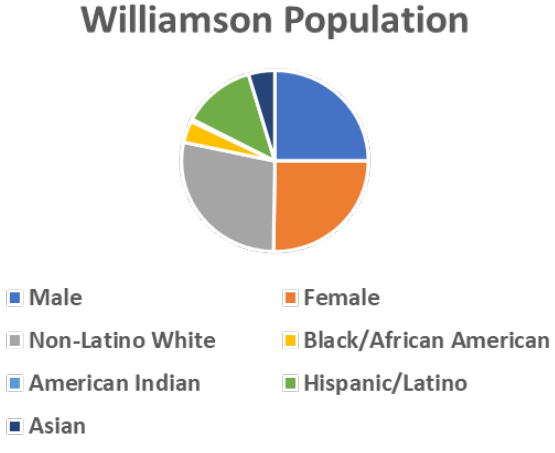

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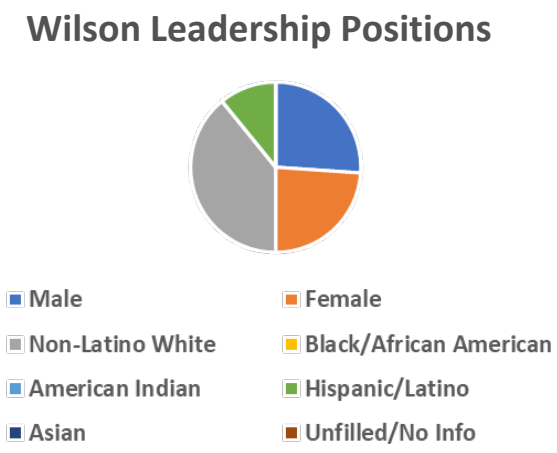

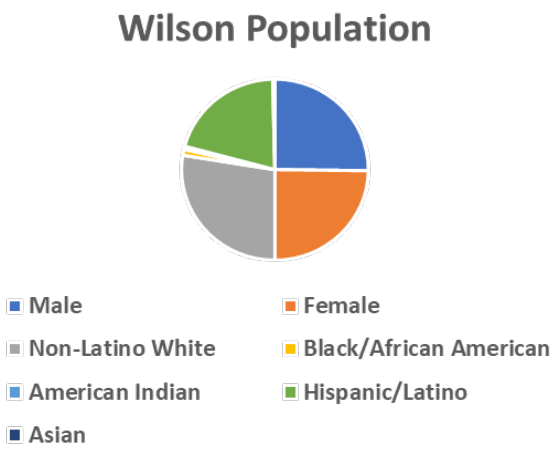

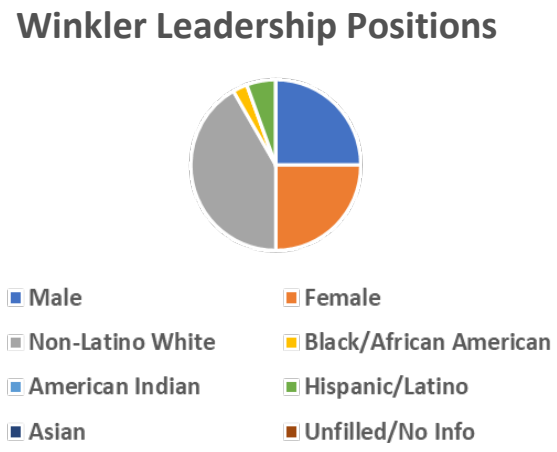

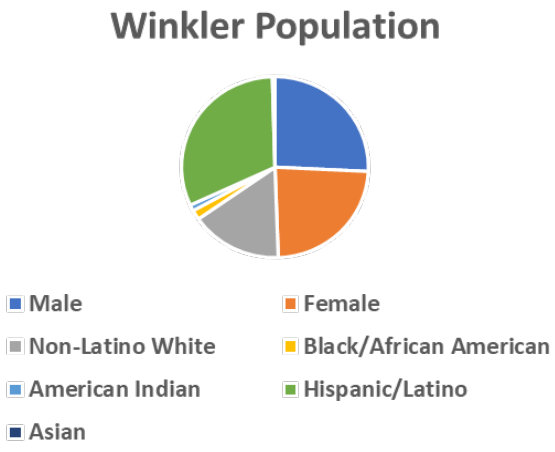

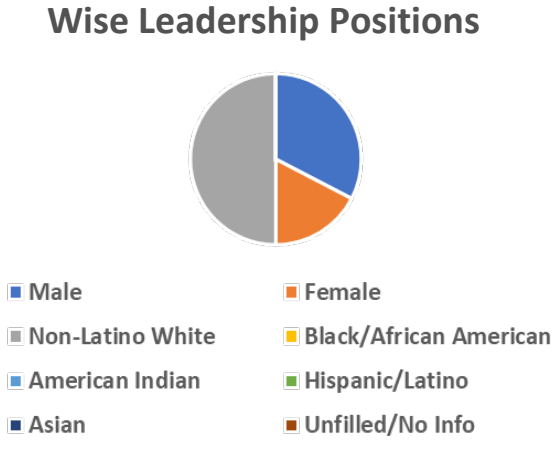

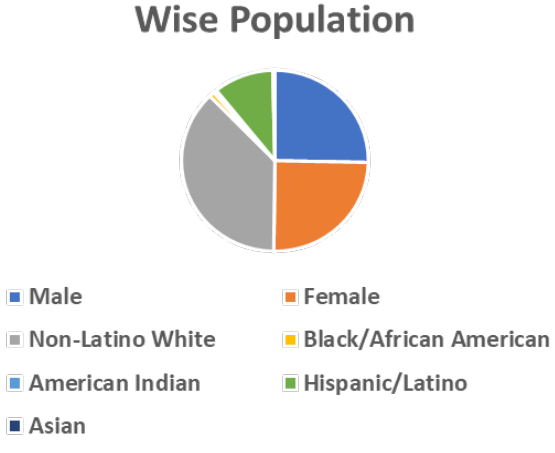

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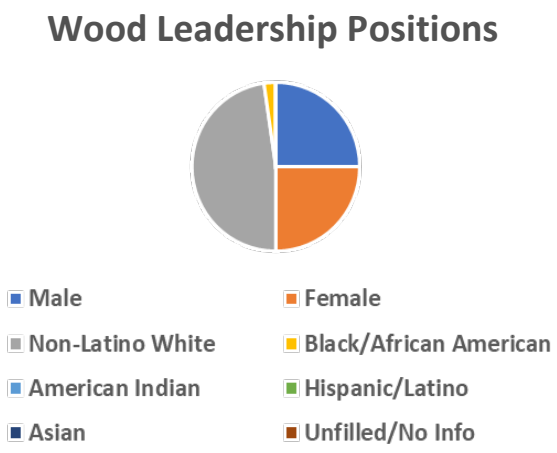

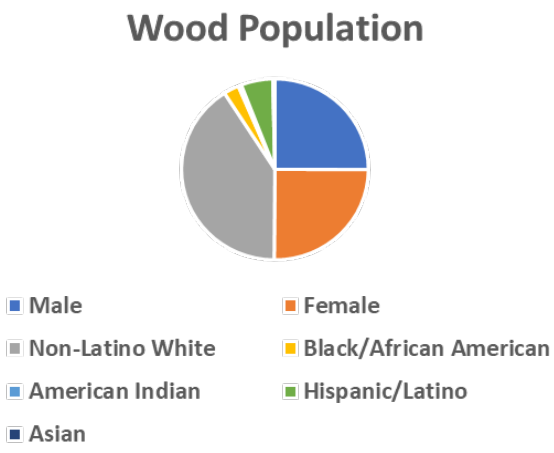

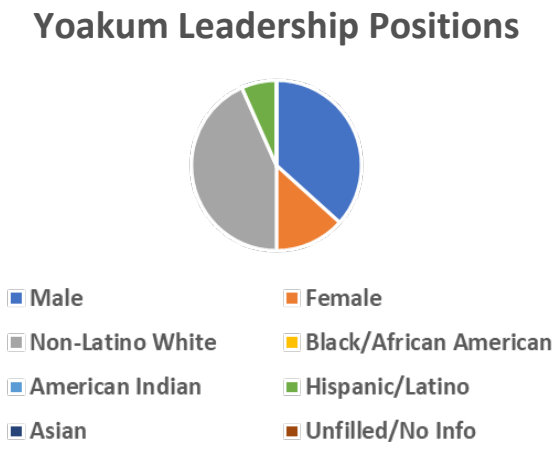

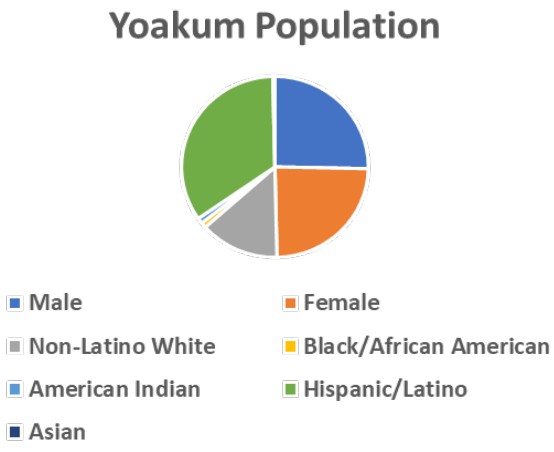

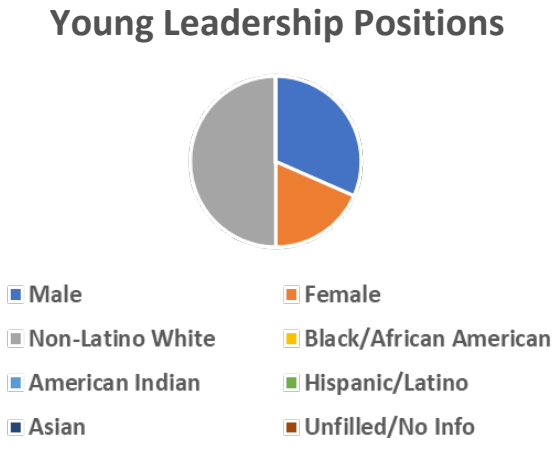

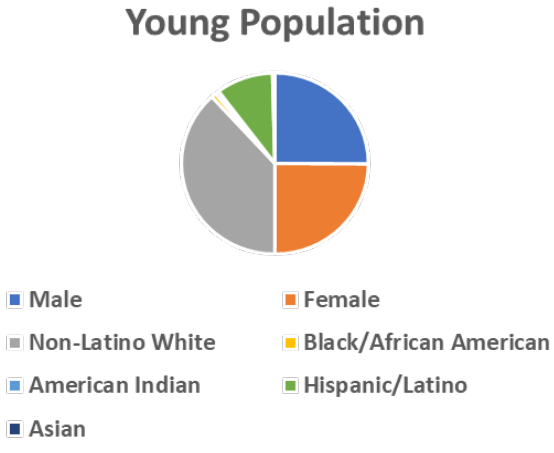

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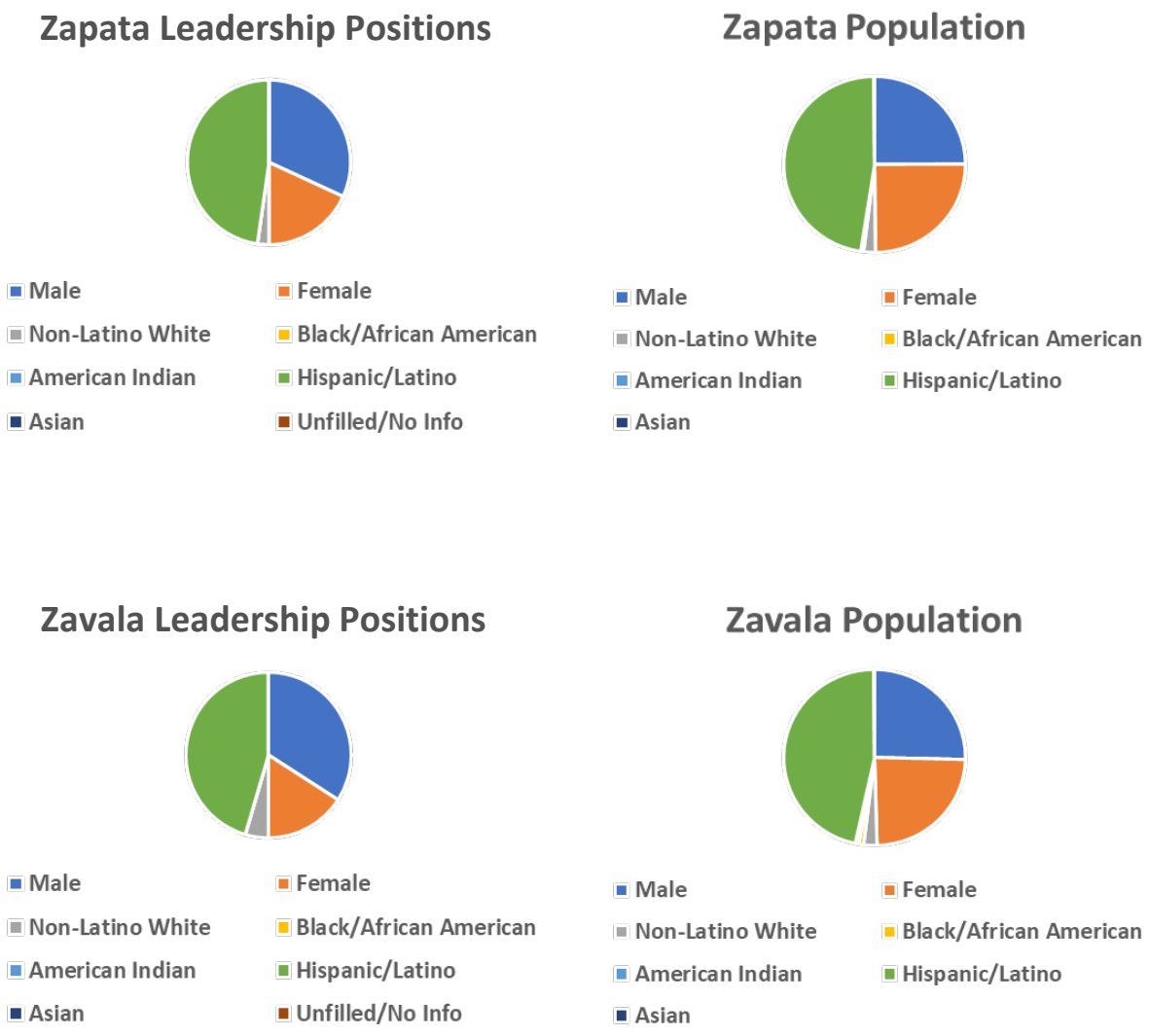


Figure 22. Continued.

Preparing future leaders is key to sustainable communities. If the intent is to increase representation of Communities At-Risk in leadership positions, then care should be given to prepare individuals to succeed, to avoid setting back community efforts and representation. Suggestions for future leadership training programs tailored to Communities At-Risk include:

1. Strategic and meaningful, paid, long-term, targeted training, involving high contact hours, particularly for water leadership positions and for rural county leadership positions, as these involve complex systems, unique community cultures and specific processes and skills.
2. Caring, long-term mentorship and supportive personal networks within professional settings – assign several individuals that are a match for recruits to create a safe environment where there is freedom to ask questions, push boundaries and gain experience, to fall and learn without fear in a supportive work family, and to receive redirection and responsibilities with expectations for success, not a lowering of standards.

Leadership training has typically centered around internships, workshops, and hands-on training activities, which are important and valid preparation pathways. Often missing are long-term, meaningful touchpoints post training and post education for recruit retention, such as consistent and continual one-on-one mentoring and training, professional social network training, and the opening of social networks or at minimum increasing their accessibility to Communities At-Risk, in this case within the professional water arena and within professional county governments. Immersion in the social and cultural networks of water and county governments is necessary, in addition to the slow introduction of and full immersion into board room meeting basics and protocols so that these become second nature. Education programs offer many opportunities but strong, long-term leadership training partnerships with community organizations, non-traditional service organizations and government offices are key to building strong leaders.

Communities At-Risk

In the U.S., certain populations tend to be more vulnerable to environmental harms. Vulnerability does not indicate the presence of an environmental issue (e.g., toxic waste site), but it does indicate the level to which that community is likely to be harmed by the presence of an environmental issue. Most methodologies used to identify Communities At-Risk look at percent people of color and percent low income as two factors because poorer communities and Communities At-Risk are more susceptible to environmental risk factors. However, the range of variables depends on the goals of the organization carrying out the screening. This report looks at 3 vulnerability indices:

1. EPA's EJSCREEN Demographic Index
2. CDC's Social Vulnerability Index
3. Economic Innovation Group's Distressed Communities Index

Together, these indices allow for a high-level screening of areas in the state that might be more vulnerable to water equity issues. Because the Census data used in these indices may not be complete, they should not be interpreted as a decisive determination of all Communities At-Risk in Texas.

EJSCREEN Susceptible Communities

The EPA developed a tool called EJSCREEN that uses a combination of demographic and environmental factors to highlight potential environmental justice communities (EJSCREEN, p. a9). The tool can be separated into Environmental Indicators, like traffic proximity, and a Demographic Index, which estimates *susceptibility* to those indicators based on the percent of people within a Census block group who are people of color or low income. The EPA uses these two demographic factors because "minority, low-income, and indigenous populations… frequently bear a disproportionate burden of environmental harms and risks" (EJSCREEN Technical Documentation, p. 6). "Minority" in this case refers to people of color, which includes anyone who is not white and not Latino. "Low Income" refers to individuals whose income is less than twice the poverty line.

The Environmental Indicators in EJSCREEN only include one water risk, related to wastewater discharge, so it cannot be used to identify communities that are likely facing water-related EJ issues. However, the Demographic Index can be used to identify communities that might be more susceptible to water issues if they occur. If we map the Demographic Index as a raw score, we see that census block groups in big cities and along the Rio Grande River appear to have a higher percentage of residents who are people of color or low income. We also see that town centers of each non-urban county tend to be more diverse or low income than their rural outskirts. When we map the Demographic Index scores as a percentile and look at the upper quartile of all census block groups, this pattern of more susceptible communities in southern counties and in urban centers becomes even more evident (Figures 23-24).

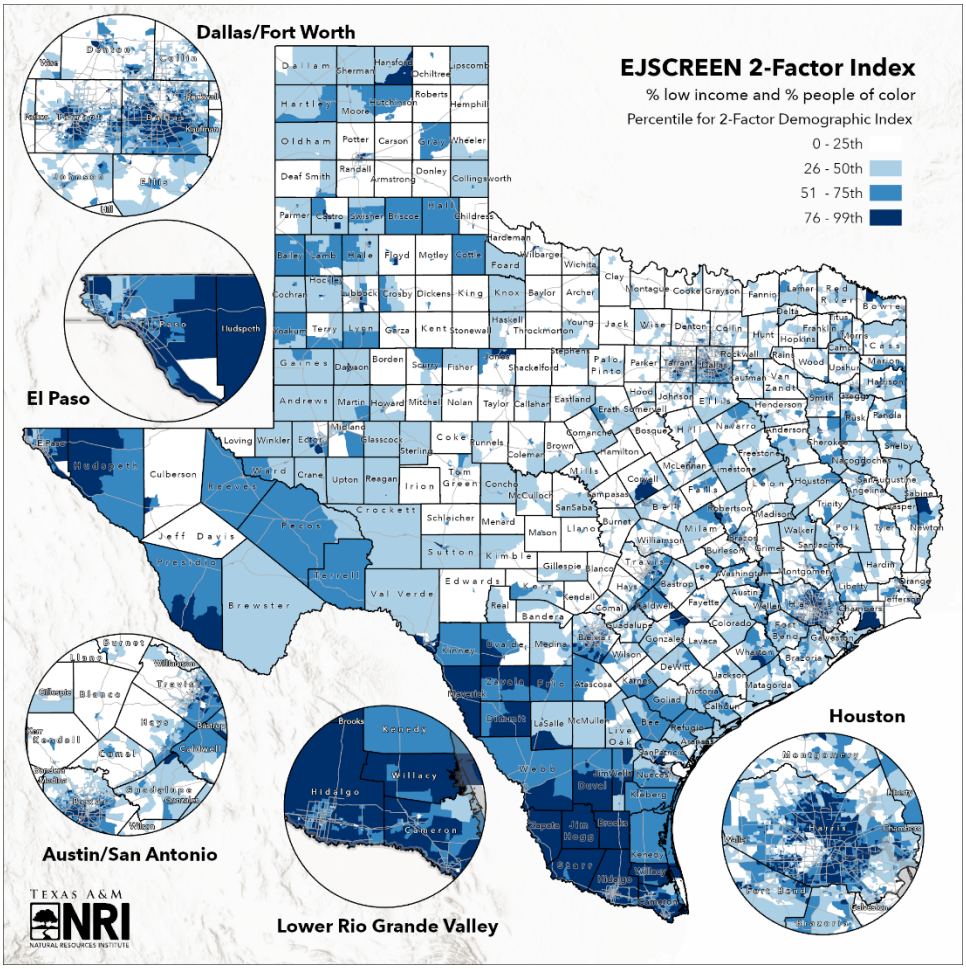


Figure 23. EPA's EJSCREEN 2-Factor Demographic Index (based on % low income and % people of color) by census block group in Texas. Source: Environmental Protection Agency (EPA).

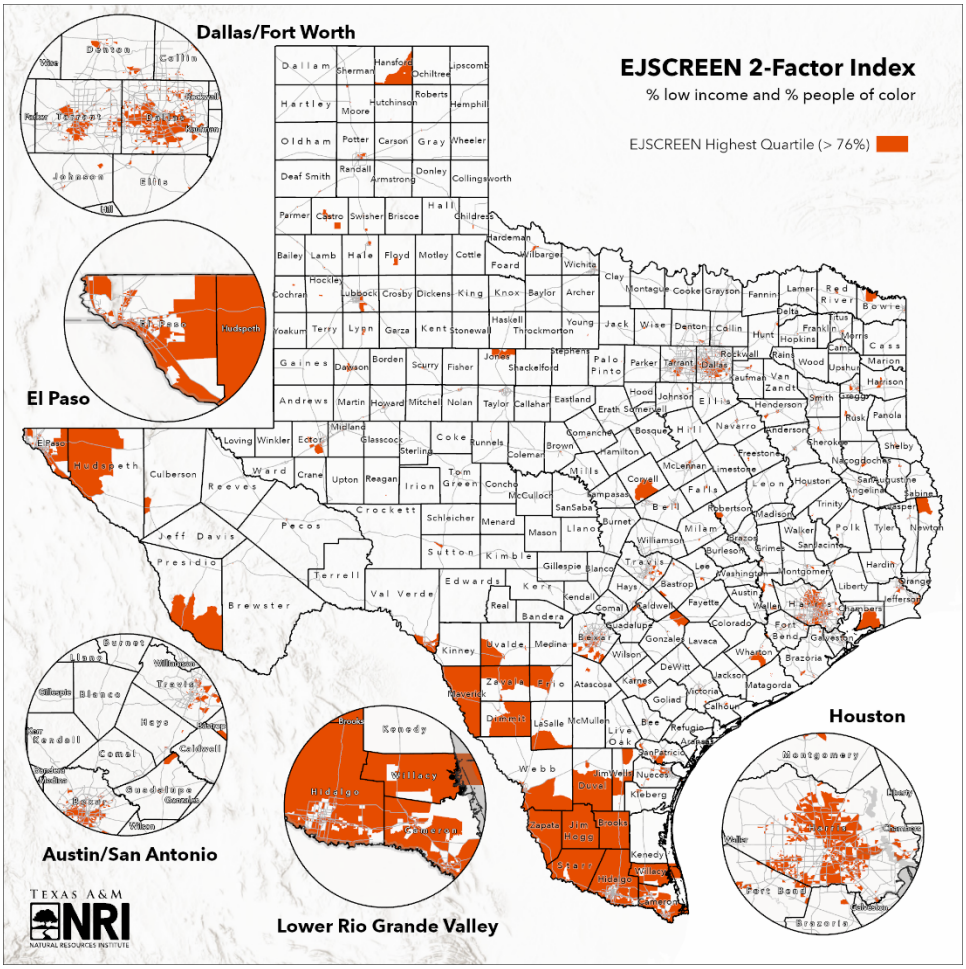


Figure 24. EPA's EJSCREEN 2-Factor Demographic Index (based on % low income and % people of color) upper quartile by census block group in Texas. Source: Environmental Protection Agency (EPA).

The raw index does not consider the size of the census block group, so it may be useful to look at the number of susceptible individuals within each Census block group as an added data point. EJSCREEN's method for doing this is as follows:

(Demographic Index for Block Group –Demographic Index for US) X (Population count for Block Group)

The result can be interpreted as "the additional number of susceptible individuals in the block group, beyond what you would expect for a block group with this size total population" (EJSCREEN Technical Documentation, p. 22). A more basic version of this formula simply multiplies the Demographic Index by the Population Count for each block group to get an approximation for the number of susceptible individuals. Based on the results of this formula, urban centers and regions along the Rio Grande River are highlighted (Figure 25).

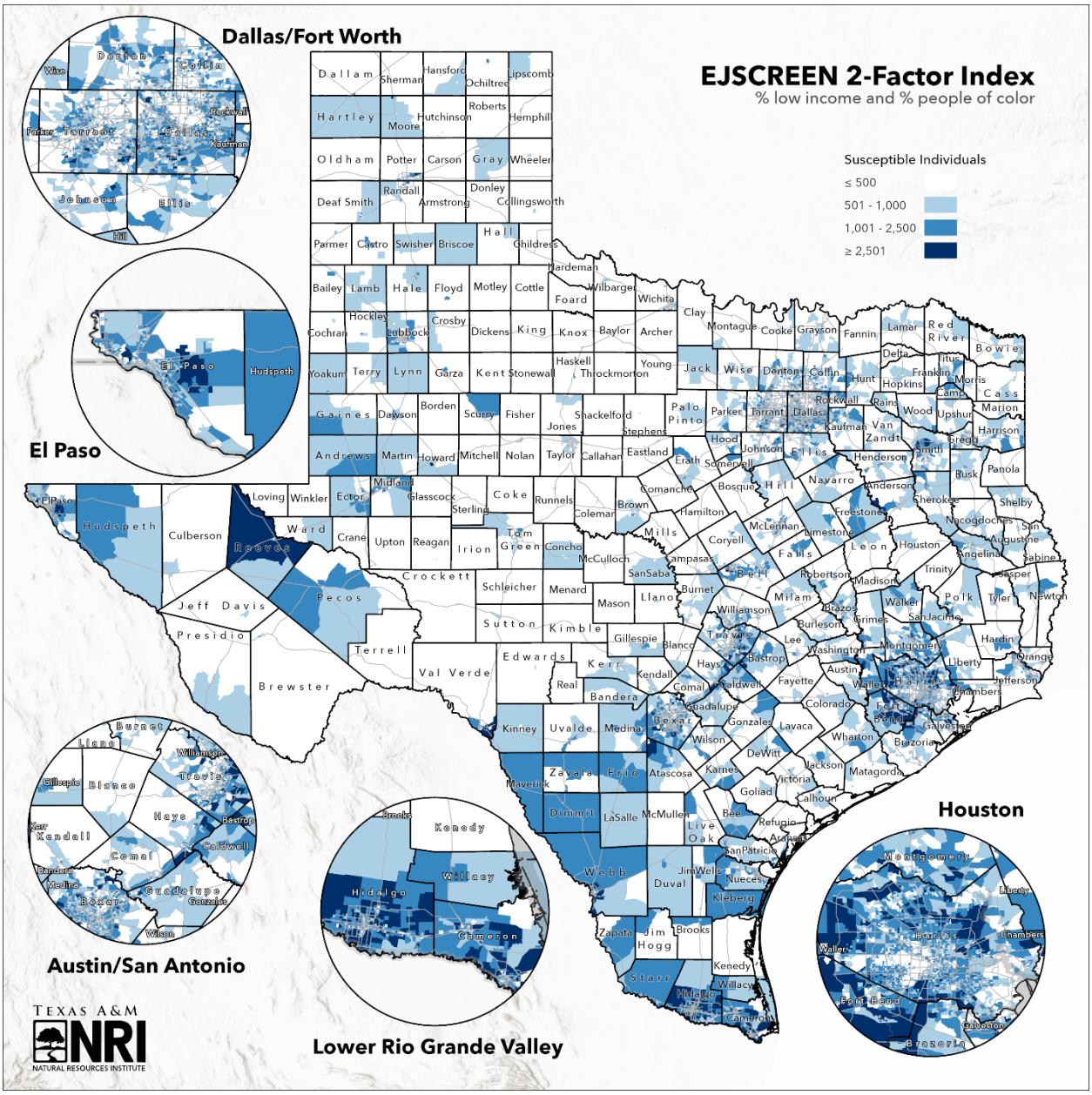


Figure 25. EPA's EJSCREEN 2-Factor Demographic Index susceptible individuals by census block group in Texas. Source: Environmental Protection Agency (EPA).

Communities At-Risk

Social Vulnerability refers to a community's ability to prepare for and respond to a hazardous event, such as a natural disaster like a hurricane or a man-made disaster like a chemical spill. The CDC created a Social Vulnerability Index (SVI) to "help public health officials and emergency response planners identify and map the communities that will most likely need support before, during, and after a hazardous event" (Source: SVI Documentation).

The SVI includes composite ranking of vulnerability for each Census tract that takes into account Socioeconomic Status, Household Composition & Disability, Minority Status and Language, and Housing Type and Transportation. Rankings are based on percentiles, with values ranging from 0 to 1. The higher the percentile ranking, the greater the vulnerability. The SVI, like EJSCREEN, allows for an analysis of relative vulnerability (SVI Documentation). However, the SVI is calculated from a total of 15 variables, and the focus is on hazardous events (Figure 26).

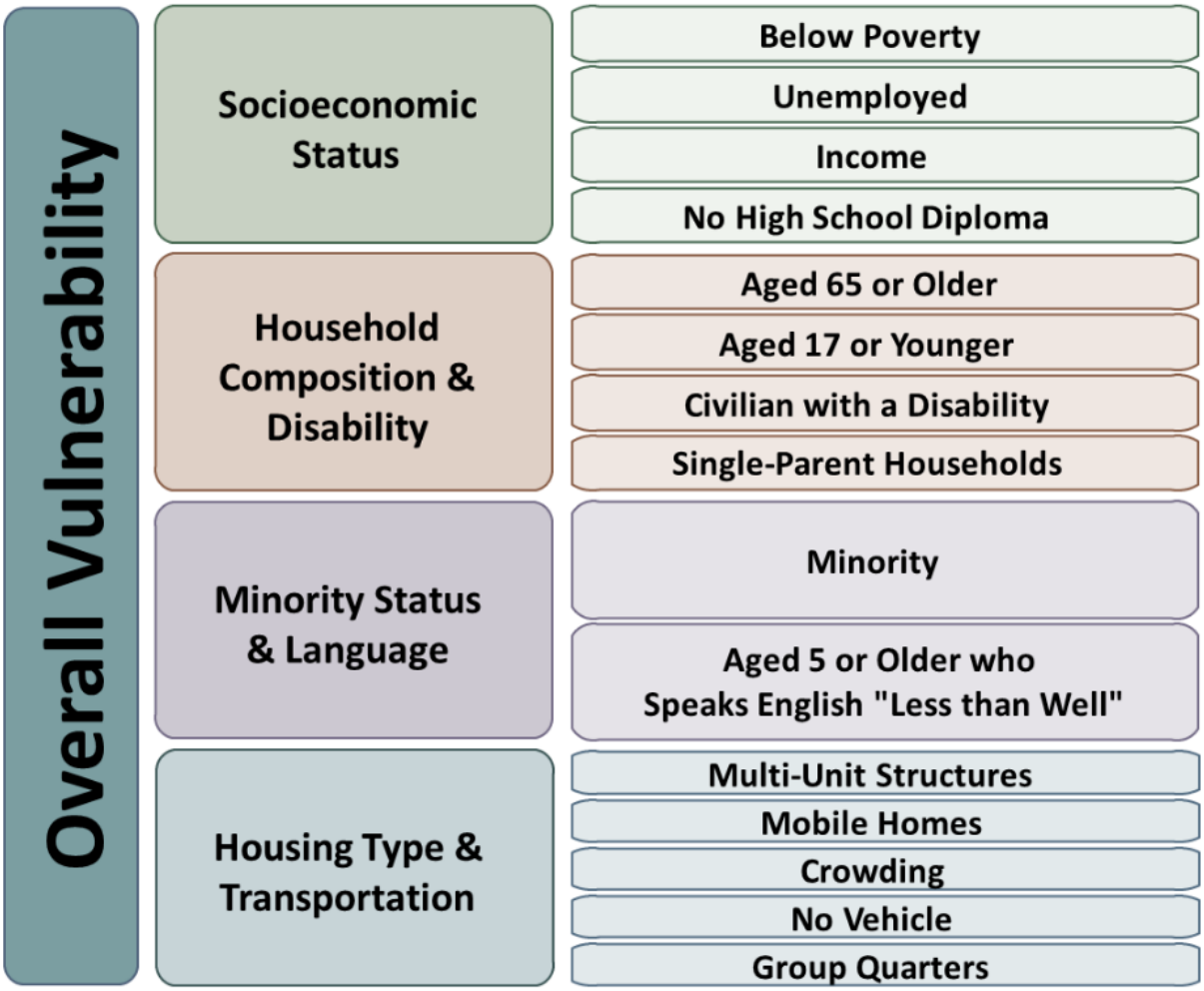


Figure 26. CDC's Social Vulnerability Index variables. Source: Centers for Disease Control and Prevention.

Based on the overall tract summary ranking variable, the most “socially vulnerable” communities in the state highlight similar patterns in larger cities and the border region (Figure 27).

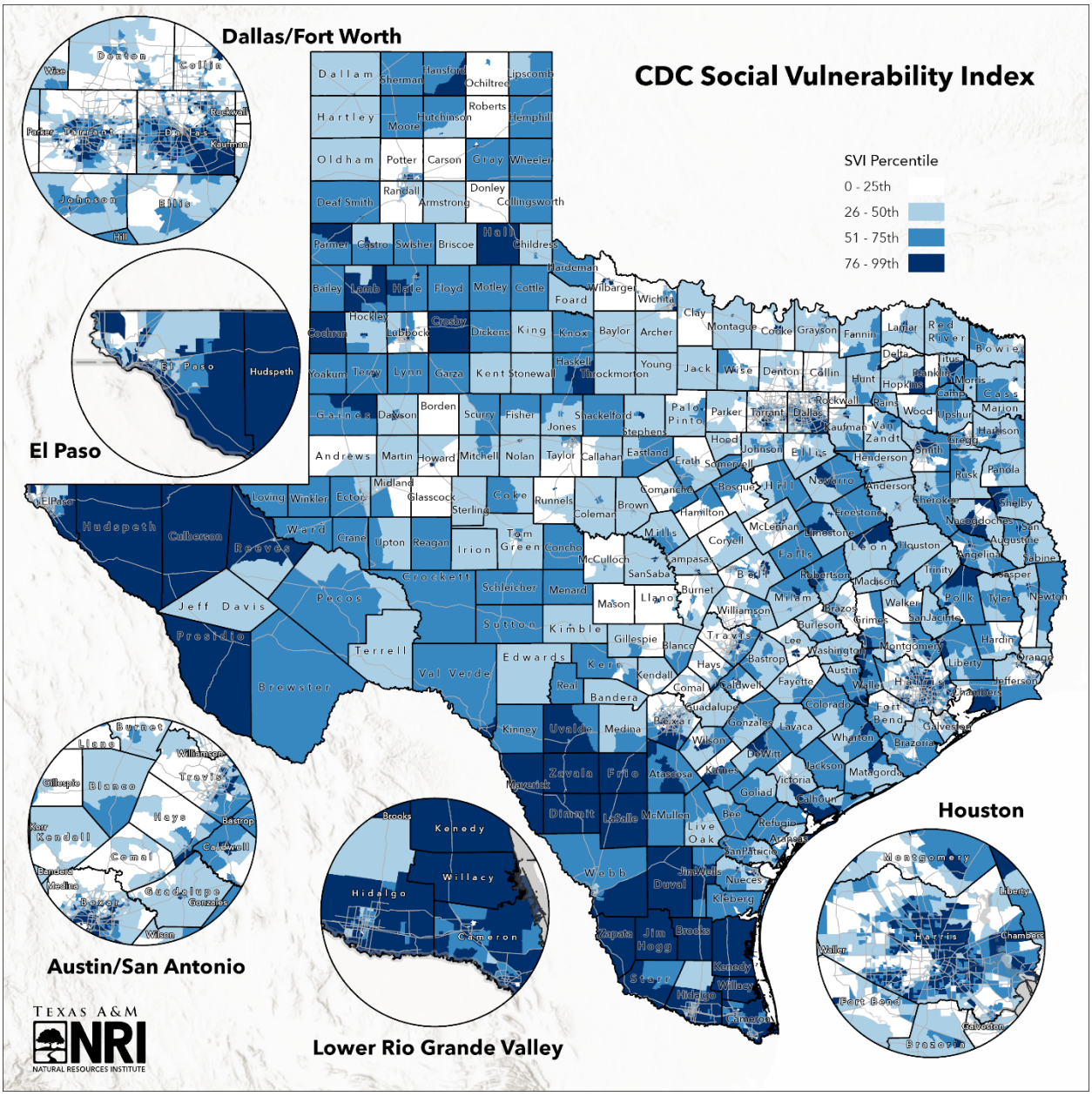


Figure 27. CDC’s Social Vulnerability Index (SVI) percentile ranking by census block group in Texas. SVI is derived from socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. Source: Center for Disease Control and Prevention (CDC).

Economically Distressed Communities

Many areas of Texas are facing severe economic distress and may be more vulnerable to displacement and water-related challenges than economically stable communities. The Economic Innovation Group produces a Distressed Communities Index (DCI) that examines economic well-being at the zip code level (Economic Innovation Group DCI). The index is based on a variety of variables from the US Census' Business Patterns and American Community Survey 5-Year Estimates for the 2014-2018 period, including Housing Vacancy Rate and Percent Change in Number of Jobs. Mapping the DCI shows similar patterns to the other indeces, but in addition, many of the state's rural areas are considered "Distressed" or "At Risk" of being distressed (Figure 28).

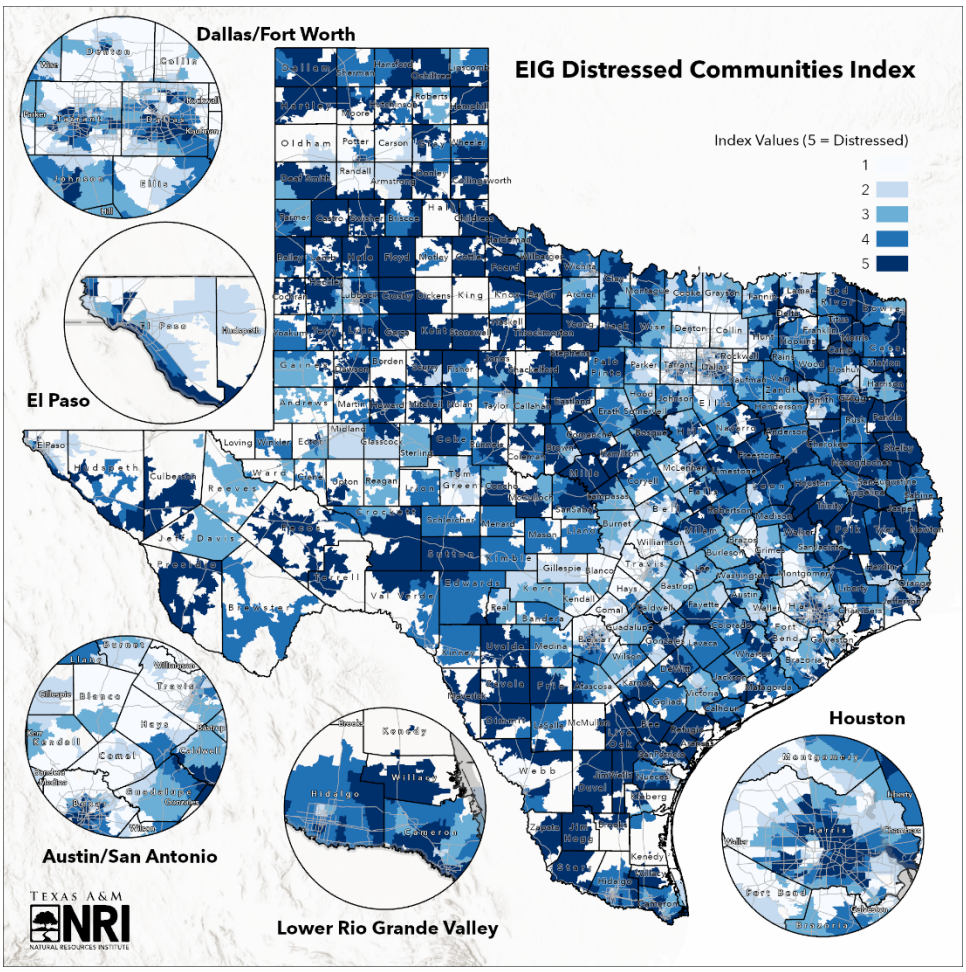


Figure 28. Distressed Communities Index (DCI) by census block group in Texas. DCI is derived from economic variables at the zip code level, including housing vacancy rate, and percent change in number of jobs. Source: Economic Innovation Group (EIG).

In closing, together these vulnerability indices allow for high-level screening of areas in the state that might be more vulnerable to water equity issues. Because the Census data used in

these indices may not be complete, they should not be interpreted as a decisive determination of all Communities At-Risk in Texas. However, it does identify key regions within the project area for targeted programming and other water conservation related activities.

Communities At-Risk Case Study: Colonias

Colonias are communities found along the Texas-Mexico border, however many Texans are unaware they exist. Colonias are unregulated settlements located in the rural outer city limits. They lack basic necessities, such as electricity and plumbing services (Texas State Historical Association, TSHA). Due to their location and other factors, they have access to a limited tax base, and it has been difficult for Colonia communities to obtaining basic utilities, such as water (Texas Colonias). In 2015, the Federal Reserve Bank of Dallas (FRBD) conducted a comprehensive study of Colonias along the borderlands in Cameron, El Paso, Hidalgo, Maverick, Starr and Webb counties. They determined the area had 2,294 Colonias, consisting of 500,000 residents, of which 96% were Latino, 73% US citizens, and 42% lived in poverty compared with the 17% statewide poverty rate, and the median household income was $28,298 compared to a statewide median income of $50,920.

According to the FRBD and the Texas Department of Housing and Community Affairs (TDHCA), Colonias first developed in the 1950s, outside city limits, where Colonia developers purchased less desirable tracts of land that were susceptible to floods and not conducive for agriculture (TDHCA). They then sold the land to families immigrating to the United States with the promise of plumbing and electricity that never came to fruition. Having invested money on property, families were unable to leave the area. “These developers platted their tracts, bulldozed roads, and sold the undeveloped lots on 10 to 20 year contracts for deed starting anywhere between $8,000 to $20,000 at an interest rate of 10% to 17% annually (TDHCA).” In 2014, 922 out of the 2,294 Colonias in Texas had access to drinkable water, wastewater disposal, legal plats, paved roads, adequate drainage and solid waste disposal (Federal Reserve Bank of Dallas).

Since basic amenities, such as water infrastructure, sewer, and electricity are largely missing from Colonia communities, many Colonia residents live in unsanitary conditions associated with lack of proper plumbing and clean water, as well as not receiving assistance with water needs. In the late 1980’s, Colonia residents near El Paso, Texas developed illnesses, such as dysentery, hepatitis, and salmonella due to the inadequate sewage systems that leaked toxic waste into their water supply (LA Times). In 2015, Colonia residents in six counties (38,000) lacked access to clean drinking water. Those who lived in flood-prone areas were more susceptible “to mosquito borne-illnesses,” and residents in proximity to farms, to pesticides (U.S. News). Each Colonia community is unique and their lived experience varies, as each is in a different stage of development along a basic utility access continuum, yet the need for water remains the same across all groups. As conditions improve within Colonia communities, organizers seek better living conditions for Colonia residents, creating less unsanitary and dangerous living conditions,

albeit Colonia residents remain under these conditions until the conditions are replaced with access to services.

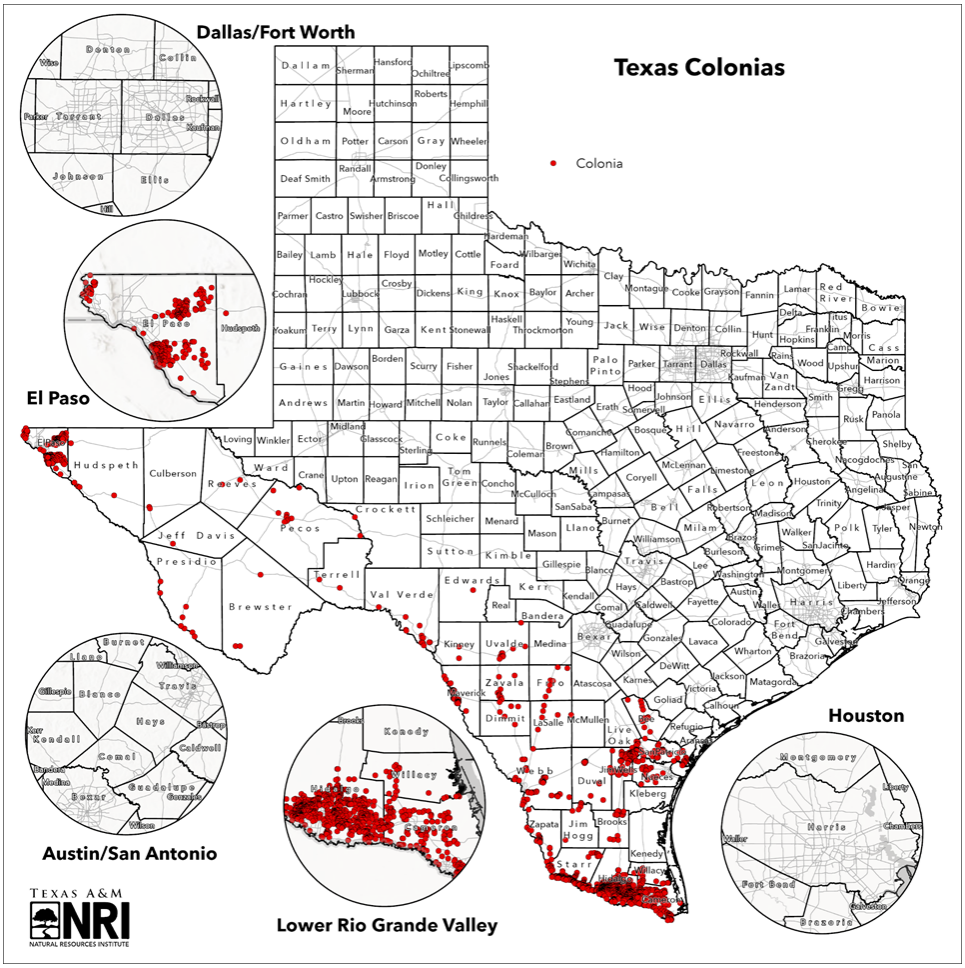


Figure 29. Colonias in Texas. Source: Texas Comptroller.

Lack of Water in the Colonias along the Texas-Mexico Border

Any water discussion and/or data pertaining to water in the state of Texas, more than likely will not include the Colonia communities of Texas (Figure 29). For Colonia communities, lack of information on access to water and not being included in conversations centering on water, has made it difficult to obtain clear and concise answers to providing for their basic daily needs. Colonias, currently defined as an unincorporated community that lacks water, sewage, and/or other infrastructures, are often simply referred to as rural communities, and more recently, they have been identified as Economically Distressed Areas (EDAs) in Texas. Under the previous Colonia definition, which only included the 14 contiguous counties along the Rio Grande, Texas was home to 2,333 Colonia communities. With the updated definition of Texas borderlands, the word "border" now includes terrain 150 miles north of the Rio Grande River, greatly expanding

the coverage area, and thus increasing previous Colonia estimates. A more accurate count of Colonia communities across all Texas borderlands will soon progress.

"To many, the concept of Colonia communities existing in Texas' backyard comes as a surprise, and it may be hard to comprehend that third world conditions exist here in Texas, in Texas' Colonia communities," says Oscar Muñoz, Director of the Texas A&M Colonias Program for over 16 years. "The term 'third world conditions' is currently an understatement when describing the conditions families endure in some Colonia communities. Water problems are abundant and quality water, accessible resources, water availability, and funding for these communities are non-existent at any planning phase or discussion with respect to obtaining water for these communities. Because Colonias are usually located in isolated, rural areas, limited development planning is instead directed towards neighborhoods, parks, libraries, among other residential and business developments, overlooking the also critical needs of Colonia communities."

To assist and learn more about these communities, the Texas Legislature funded a project, The Colonias Program, which established a training academy for residents and community leaders to become Texas A&M community health workers, also known as *Promotoras*. Promotoras are health care workers who inform residents about health-related issues and who teach families health care literacy (Federal Reserve Bank of Dallas). Promotoras also live in the Colonias, so they are in touch with the day-to-day life and struggles of Colonia residents, and they know what help their community needs. Through Promotoras, residents can get information on prenatal care, help with Medicaid and CHIP registry, and can also learn how to lead a healthy lifestyle. These programs are important because they make access to health care information more accessible, where otherwise, the lack of money and transportation for Colonia residents (communities too far from city centers and services) would make visiting a doctor impossible. Many Colonia residents experience income related health issues, such as diabetes, obesity, and cardiovascular disease. Promotoras can educate residents on how to manage these income-related health challenges and strive for healthier lifestyles.

Oscar Muñoz describes Colonias: Colonias often lack infrastructure, which in itself creates a snowball [effect] resulting in many burdens for residents, to include not having access to clean water. For Colonia residents, access to clean water is a luxury that is not taken for granted. The lack of access to clean water causes many health challenges for residents, that are not often experienced by communities equipped with water infrastructure, such as stomach illnesses from water containers not being sanitized. Similarly, lack of water access contributes to the obesity rate, because it is easier for residents to drink a can of sugary soda, than it is to drink clean water, which may not be readily available. Transportation access and associated costs also influence water access for Colonia communities. Colonia residents live in rural, isolated areas, and the water sources they need are located in cities, a far distance from each other, further complicating access to affordable, clean water and creating an additional financial burden for Colonia families. Equally contributing to decreased access and affordability are the sometimes limited and often deficient infrastructure within Colonias, such as roads, which are difficult to navigate, especially during rain or snow, further compounding the level of difficulty Colonia residents experience when obtaining water from city water stations. Lack of adequate infrastructure creates a snowball of pervasive challenges for Colonia communities.

According to Mr. Muñoz, "Utilities are controlled by cities not by rural county commissioners. The lack of representation makes it difficult for water issues to be addressed. Unregulated water distribution, lack of information for residents on how to clean containers for water, and distrust of government entities [adds to the challenges], since it would seem that it should be a priority to have clean water for Texas residents. All Texans should have access to clean water and to live healthy lives."

Communities At-Risk Case Study: Freedom Colonies

Freedom colonies are places where formerly enslaved people settled during the Reconstruction and Jim Crow eras in Texas following Emancipation. From 1865-1930, African Americans accumulated land and founded approximately 557 Black settlements or freedom colonies. Freedom colonies were intentional communities created in response to political and economic repression by mainstream white society. In these places, Black Texans could much better avoid the perils of debt bondage, sharecropping, and racialized violence from white communities, and live largely self-sustaining, independent lives on their property (Sitton, T., & Conrad, J.H. 2005). Concentrated primarily in the eastern and central parts of the state, freedom colonies arose close to the plantations which once held them in bondage and where arable farmland was available. Since their founding, freedom colony descendants have dispersed, and hundreds of settlements' statuses and locations are unknown. "Gentrification, cultural erasure, natural disasters, resource extraction, population loss, urban renewal, and land dispossession have contributed to their decline. Freedom colony descendants' lack of access to technical assistance, ecological and economic vulnerability, and invisibility in public records has quickened the disappearance of these historic Texas communities" (The Texas Freedom Colonies Project).

Only within the last 30 years have settlements like Bordersville, Riceville, and Fifth Street, which had suffered from municipal underbounding, finally accessed clean water-sewer services. Rural communities like Tamina, in the shadow of the well-to-do Woodlands, Montgomery County, have long suffered from flooding due to poor drainage and inadequate water and sewer services. Sand Branch, a freedom colony, located southeast of Dallas with a small population of around one hundred people, still struggles to access clean drinking water. "Sandbranch has no water pipes, sewerage, trash collection, or streetlights. In an added dash of irony, the sprawling Dallas Southside water treatment plant is situated about 10 yards from Sandbranch, its rusting barbed wire fence running along the northern boundary of the town" (The Guardian). While the public is familiar with the absence of clean water in communities like Flint, Michigan, most do not know that there are other Black settlements, such as Sand Branch, whose residents live in chronically under-resourced communities with poor infrastructure. Sand Branch's population is majority African American, and many believe that the freedom colony's racial makeup is why they haven't received assistance. "We don't have water here, and you know why?" asked Ivory Hall, a spry 83-year-old Black man who deftly slaps my arm as he makes his point. "The pigment of my skin. If I were white like you, I bet they'd have water down here" (The Guardian). Rick Loessberg, planning director at Dallas County, said about Sand Branch, "we tried to get them water, but with the cost involved and a declining population, was it good policy to spend

millions of public dollars for 88 people?" (The Guardian). In 2020, the all-volunteer board of the Sandbranch Development and Water Supply Corp was awarded a grant from the Texas Water Development Board to create a plan and design for the needed water line and sewer management construction project. However, millions more will be required to buy treated water and treatment services from Dallas Water Utilities (Dallas Morning News, Dallas Observer).

The Texas Freedom Colonies Project has shown light on these and hundreds of other African American communities in Texas that are disproportionately affected by environmental racism and underinvestment in infrastructure. The Project was founded in 2014 by Dr. Andrea Roberts, a professor and freedom colony descendant, who mentors, and trains future planners, preservationists, scholars, and community-based researchers focused on addressing the biggest challenges facing Black settlements in Texas and around the country—invisibility, environmental injustice, land loss, heritage conservation, and endangered historic structures and cemeteries. Dr. Roberts' research states that "Freedom colonies (FCs) were often found in bottomland in low-lying areas. The legacy of these geographical vulnerabilities is highlighted by the FEMA - Hurricane Harvey Impact layer of the Texas Freedom Colony Atlas (Figure 30), which shows that 229 FCs are in fifty-three FEMA-designated counties, constituting 41% of total FCs." The prevalence of unclear titles among landowners and the lack of historical integrity of properties in freedom colonies made their churches, schools, and homesteads less likely to be endangered by public preservation agencies, and accessing FEMA and HUD-funded disaster recovery funds was difficult.

The Atlas generated from ethnographic field research, and crowdsourced survey data indicates the vulnerability of remaining historic sites in freedom colonies (Figure 31). The Texas Freedom Colonies Project's mission is to prevent the erasure, destruction, and decay of cultural properties within settlements through collaborative engaged research with descendant communities. Cultural properties include homes/farmsteads, churches, cemeteries, and schools. Roberts' team's research shows that cemeteries, at times the only remaining feature in freedom colony landscapes, were disproportionately cited in flood zones and close proximity to chemical plants. These cemeteries "were most heavily concentrated in 'exposure zones' where they were more likely to encounter these hazards" (Guardian). With the aid of a 2019 African American Cultural Heritage Action Fund Grant, the team was able to develop and test an online assessment form that can help descendant communities identify, monitor, and organize their response to environmental challenges, such as flooding, to their burial grounds. Mapping these settlements has increased public awareness of their existence and forced some planning and development agencies to acknowledge their rich history and the harm their projects could cause to remaining cultural properties before their projects begin.

The Project is an educational, social justice initiative dedicated to preserving the heritage of Texas' historic African American settlements, and the planners and preservationists that made them possible" (The Texas Freedom Colonies Project). The Project has developed a website with educational resources for researchers and descendants and an interactive map where descendants can add place histories and memories to the growing settlements database, access the location of many freedom colonies, and learn about how African Americans founded these communities.

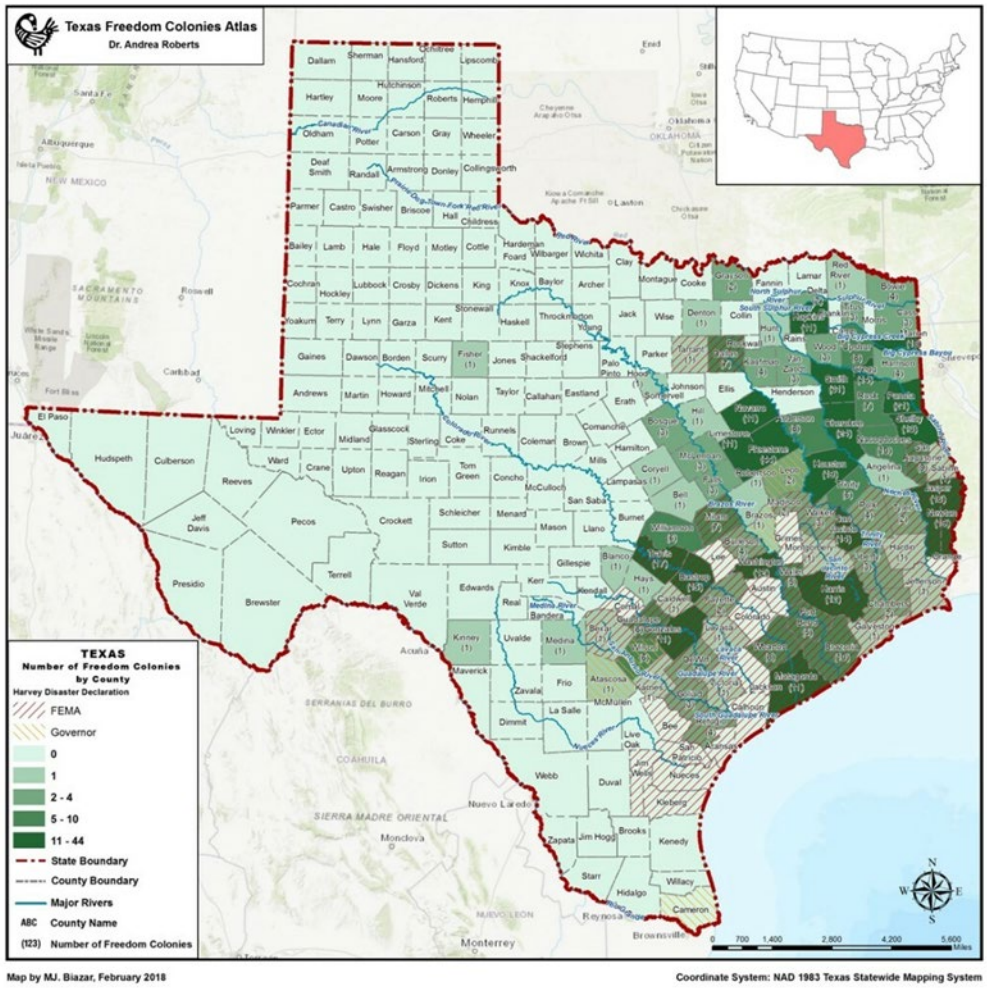
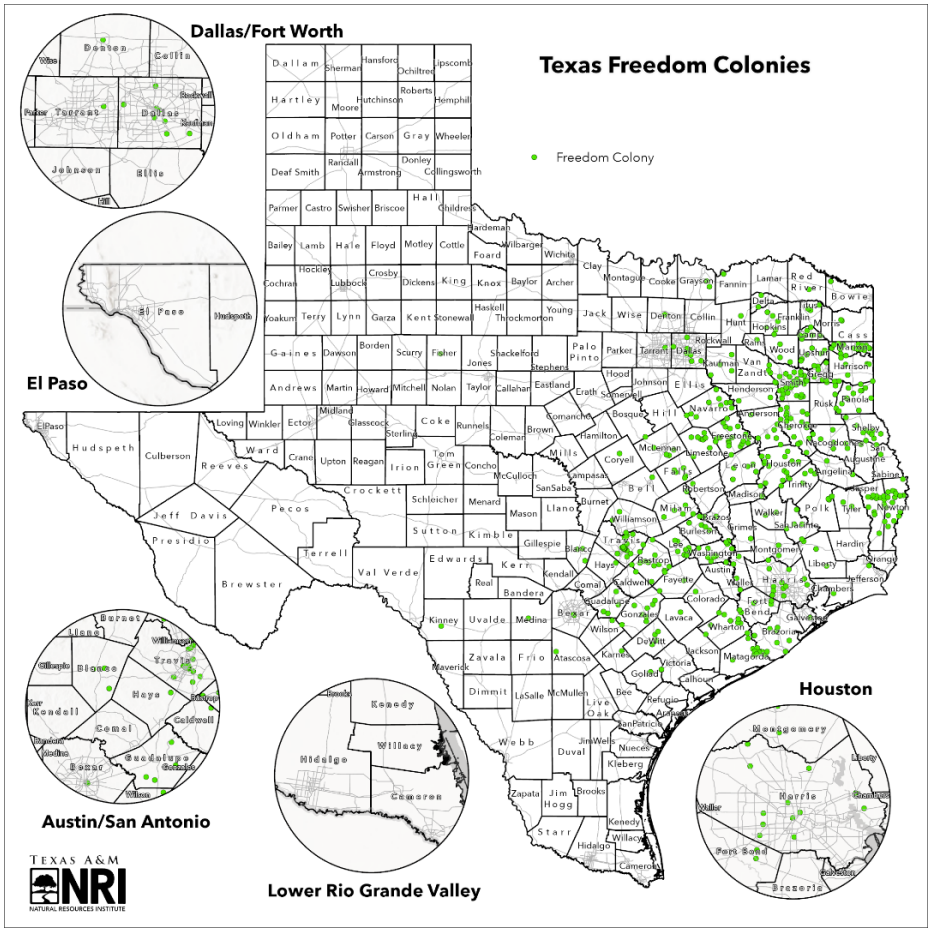


Figure 30. The FEMA -Hurricane Harvey Impact layer of the Texas Freedom Colony Atlas (Roberts and Biazar 2019).



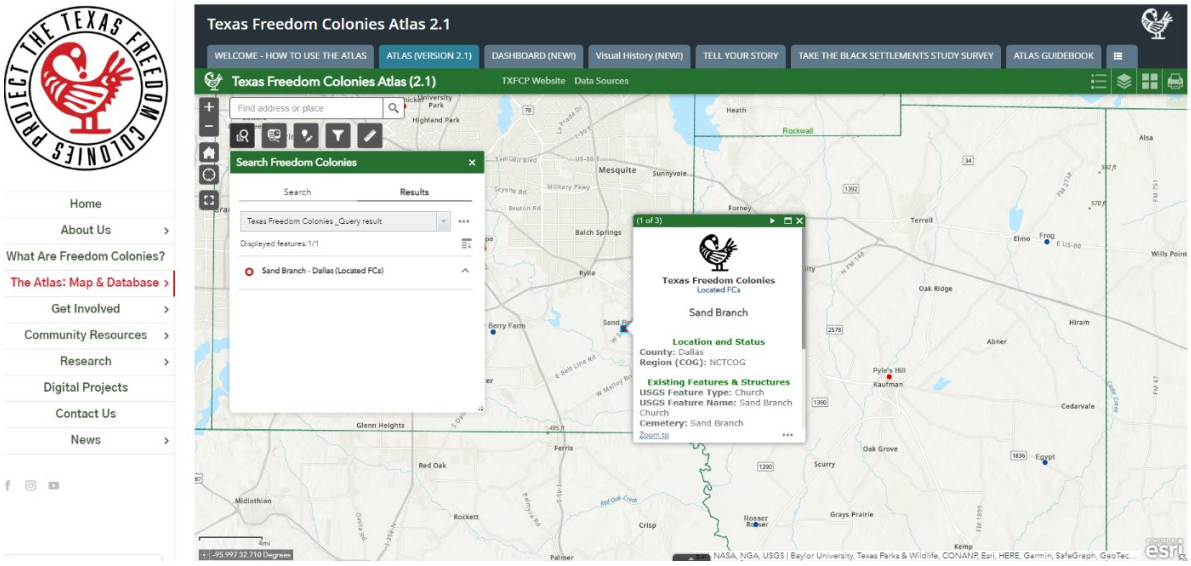


Figure 31. (Top) Current Texas Freedom Colonies in Texas. (Bottom) The Texas Freedom Colonies Atlas 2.1 maps out the research collected so far, with 464 locations currently plotted. View the interactive map, access the guidebook, and learn more about freedom colonies. Source: Texas Freedom Colonies and The Texas Freedom Colonies Atlas 2.1.

Key Take-Aways

- In review of the state's demographics, Communities At-Risk are primarily found in urban areas. Additionally, South and Far West Texas are mostly Communities At-Risk. In contrast, most rural Texas demographics are predominantly white and older populations. Communities At-Risk in Texas are predominately Latino followed by African American.
- Action: Programming and engagement strategies of these Communities At-Risk should consider location, cultural relevancy, and the predominant communities being served. For the former (location), the nexus of data for Communities At-Risk and water challenges can serve to address water equity challenges and opportunities for meaningful community engagement.
- Population density, age, and race and ethnicity are expressed primarily at a regional scale (urban and rural), where urban areas are characterized by diverse, younger and higher density population groups, and rural areas are characterized by less diverse, older and lower density populations.
- In contrast, poverty, income, unemployment, labor, and education are expressed at a local scale, meaning zip codes or neighborhoods matter within a given area. In Bexar County, for example, these variables are expressed within a county locally compared to more regional differences. This is not surprising given drivers in vulnerability indices described in the report are framed by these factors, resulting in the demographic makeup of the state.
- Action: Communities At-Risk are locally distributed and not random within urban areas. Within rural areas, zones of Latino prevalence are small compared to land mass. Mapping of Communities At-Risk is helpful for EDF programming and engagement strategies that are targeted and purposeful.
- Action: Linguistic isolation can be an important barrier to water resources for Communities At-Risk, particularly for safety (flooding and drought). Preference for Spanish materials manifested as low in rural areas compared to other parts of the state. This may be associated with preferences in receiving information or that pockets of Latino community respondents were too small in rural areas to influence overall survey results. Some bilingual programming efforts may be beneficial, especially along border regions and urban areas.
- Rural landowners are primarily Non-Hispanic White, male and older, reflective of rural communities. Non-Hispanic White rural landowners control 87% of Texas' ecosystem service benefits.
- Policymaker structure is also reflective of their county population with respect to race, age, and ethnicity, similar to rural and urban counties, with some exceptions.
- Action: Because pockets of Communities At-Risk are in rural areas, they may not be well represented in policy-maker structure. EDF program and engagement strategies might include:
    - Strategic and meaningful, paid, long-term, targeted training, involving high contact hours, particularly for water leadership positions and for rural county leadership positions, as these involve complex systems, unique community cultures and specific processes and skills.

    - Caring, long-term mentorship and supportive personal networks within professional settings – assign several individuals that are a match for recruits to create a safe environment where there is freedom to ask questions, push boundaries and gain experience, to fall and learn without fear in a supportive work family, and to receive redirection and responsibilities with expectations for success, not a lowering of standards.
- Action: Community engagement models supported by both case studies (The Texas Freedom Colonies Project and the Texas A&M University Colonias Program), each with a long history of successfully engaging and training community members, returning trained members to their respective communities and to other aspects of active, in-community service, and with engaging in various aspects of community science to the benefit of communities.
- Action: There was congruence between models of Communities At-Risk where each of the three approaches validated one another. A shortcoming of many of these modelling approaches is that they may not specifically include water challenges in a more comprehensive fashion, thus, integrating location of Communities At-Risk and explicit water challenges as was conducted in this study would aid EDF programming and engagement efforts. Further mapping at higher or more local resolutions may be beneficial in future efforts.

Section 2: Water Characteristics in Texas

Overview

Water intersects the lives of all Texas residents in countless ways. The aquifers and rivers provide water for drinking and irrigation and are a source for recreation. On the other hand, polluted waters can negatively impact health, floods can cause severe physical and economic damage, and high-water prices can burden families financially. While there are many ways to approach a landscape analysis of water in the state, this report analyzes water as it relates to the categories of water supply, water quality, flooding, affordability, and access to recreation.

Water Supply

According to the 2022 Texas State Water Plan, 187 out of 254 counties in Texas are expected to see an increase in demand for water between 2020 and 2050 (Figure 32).

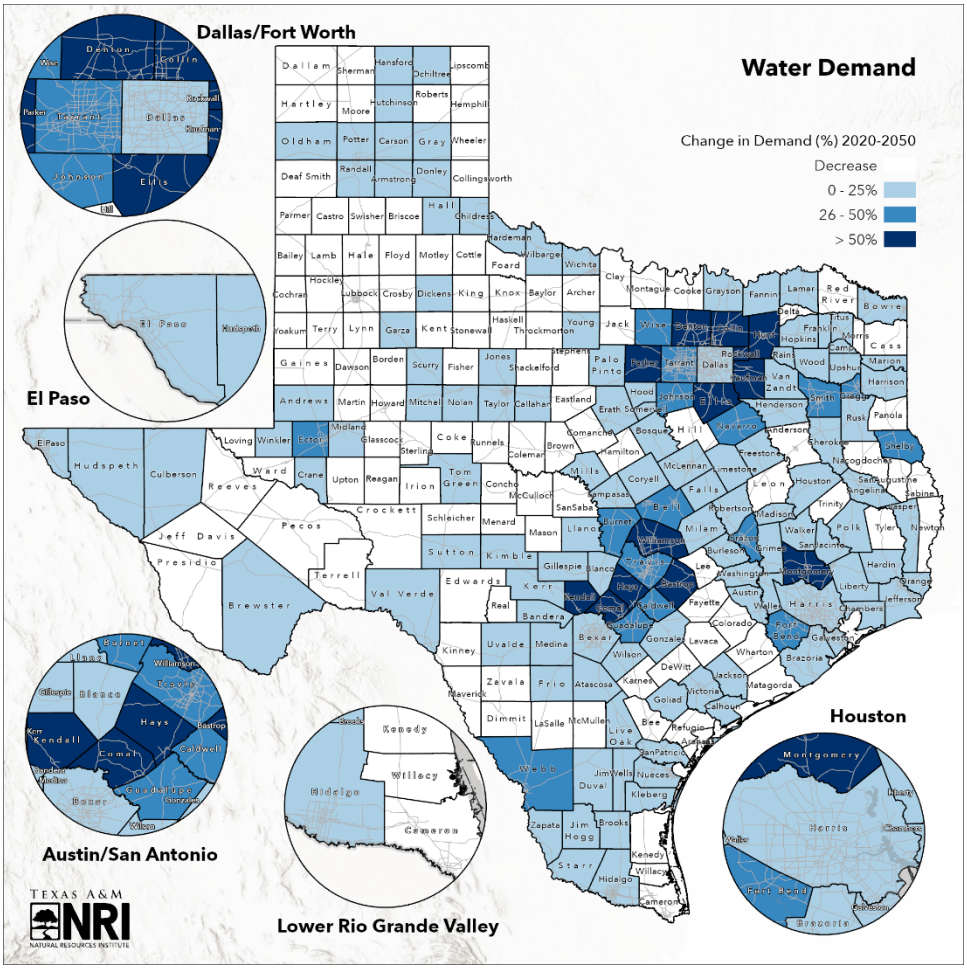


Figure 32. Change in water demand from 2020 to 2050 by county in Texas. Source: 2022 State Water Plan, Texas Water Development Board (TWDB).

A sizable portion of that growth is driven by population growth. For example, Hays County is expected to see a population increase of 98%, and an increase in water demand of 78% between 2020 and 2050 (State Water Plan 2022).

As a result of this increased demand, the SWP predicts that 208 out of 254 counties will experience unmet water needs (i.e., shortages) by 2050 unless new water supplies are developed (State Water Plan 2022, Figure 33).

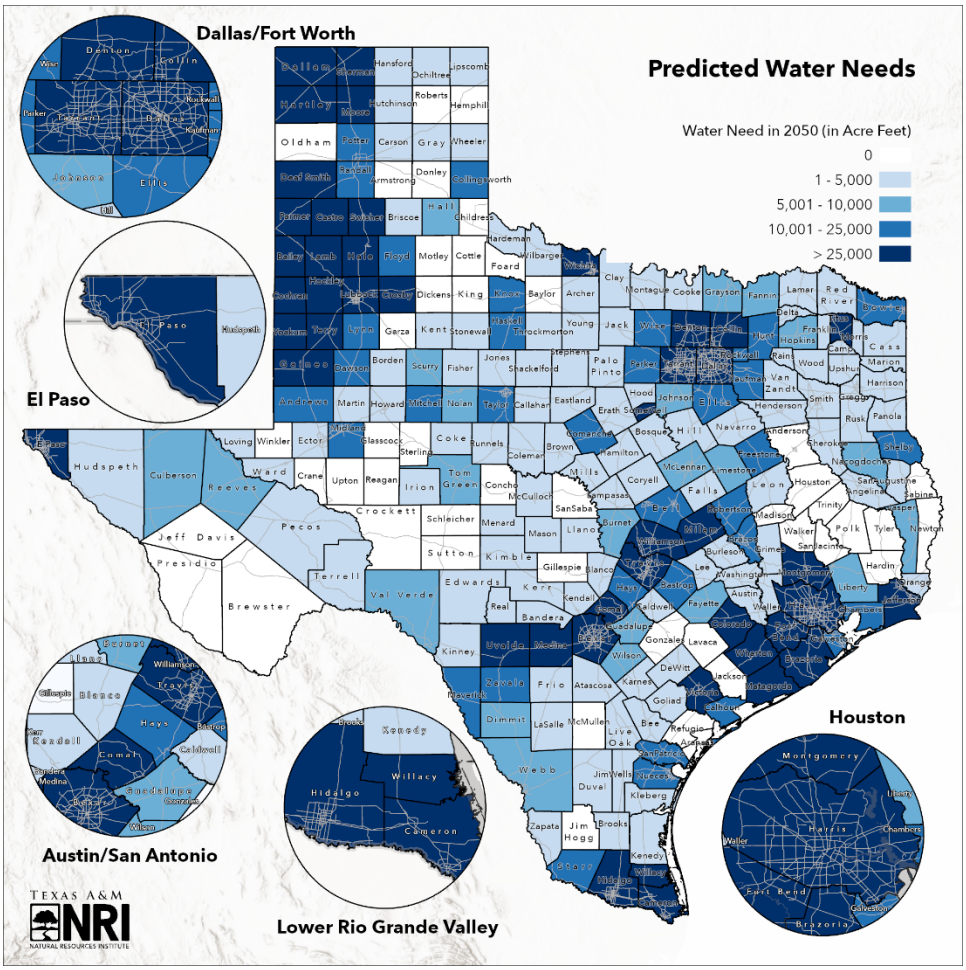


Figure 33. Predicted water needs in 2050 by county in Texas. Source: 2022 State Water Plan, Texas Water Development Board (TWDB).

Regional Water Planning Groups are tasked with recommending water management strategies to address these shortages. In many counties, these strategies include the development of new groundwater wells (Figure 34). The SWP's reliance on groundwater development as a strategic supply could raise equity concerns because well levels have experienced declines in many parts of the state (Meadows Report 2021).

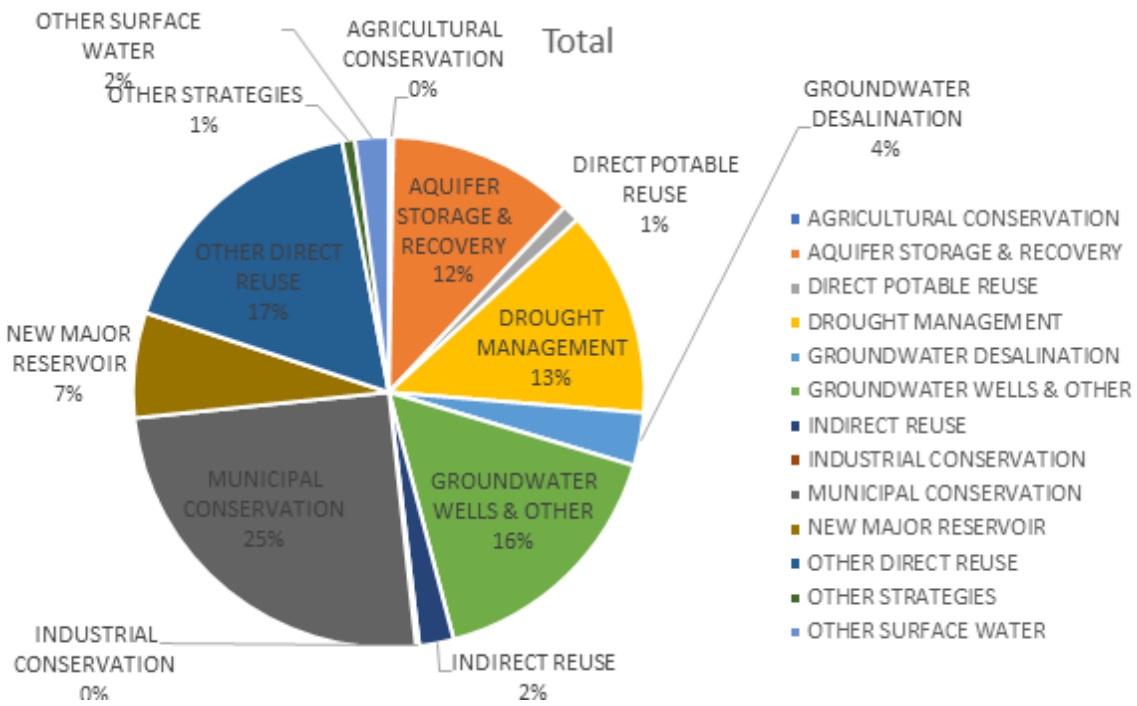


Figure 34. Water supply strategies for 2050 in the Texas Hill Country. Source: 2022 SWP, TWDB.

For example, The Nature Conservancy's Water Explorer tool, which compiled data from TWDB monitoring wells, shows that in the southern portion of the Hill Country, many wells had decreased water levels when compared to levels in 2000 (Figure 34). Of high concern are those counties that have experienced well declines along the I-35 and I-45 corridors. In these counties and others across the state, *short-term data on well declines may not be reflective of the long-term viability of the aquifer*. Kerr and Bandera counties have relatively low coverage from Public Water Systems and some of the highest estimated well water declines in the region (Meadows Report 2021). They also have many low-income households. These trends raise concerns about the impact of aquifer level decline on poorer communities that rely on well water (Figures 35-36).

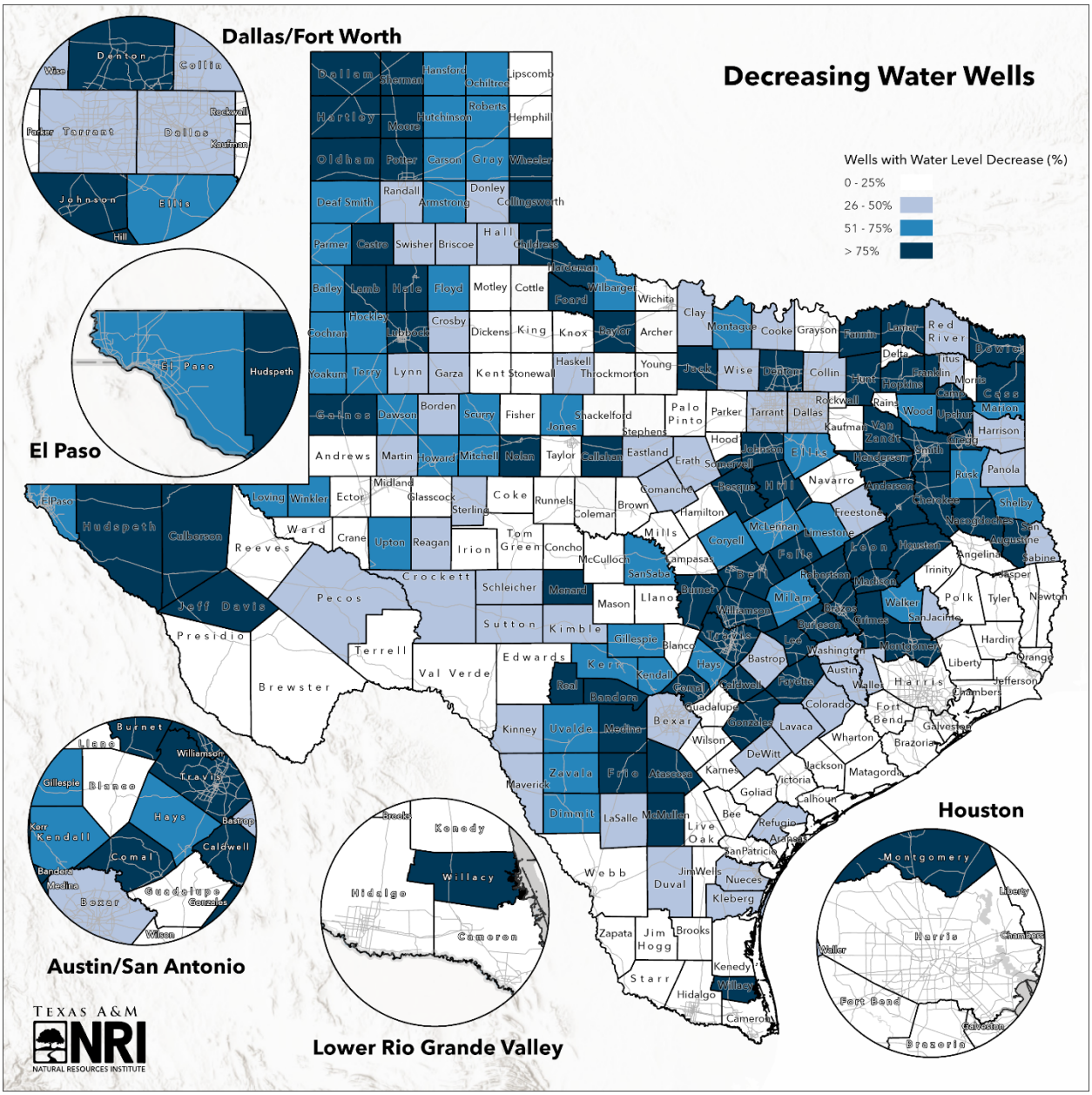


Figure 35. Percentage of wells with decreasing water levels sampled from 2000–2014 by county in Texas. Source: 2022 State Water Plan, Texas Water Development Board (TWDB).

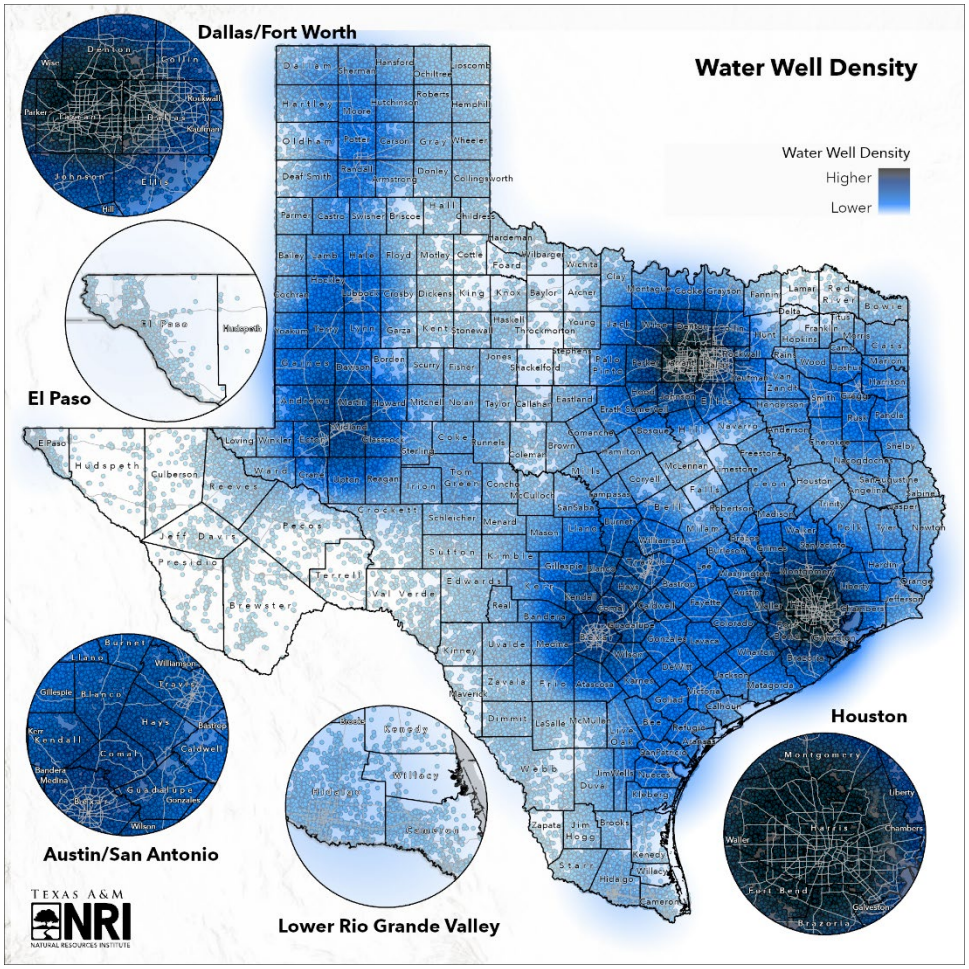


Figure 36. General density of water wells in Texas. Source: Submitted Drillers Report Groundwater Database, Texas Water Development Board (TWDB).

Water Quality

Water quality in this report refers to both drinking water quality and the quality of water in local rivers and streams since both can impact public health. For public drinking water supplies, it is possible to look at reports of drinking water violations to assess general issues with water quality (Figure 37). Based on these violations, the size of the drinking water system has a significant impact on water quality, with smaller systems appearing to have the highest number of violations. There does not appear to be a spatial pattern to these violations.

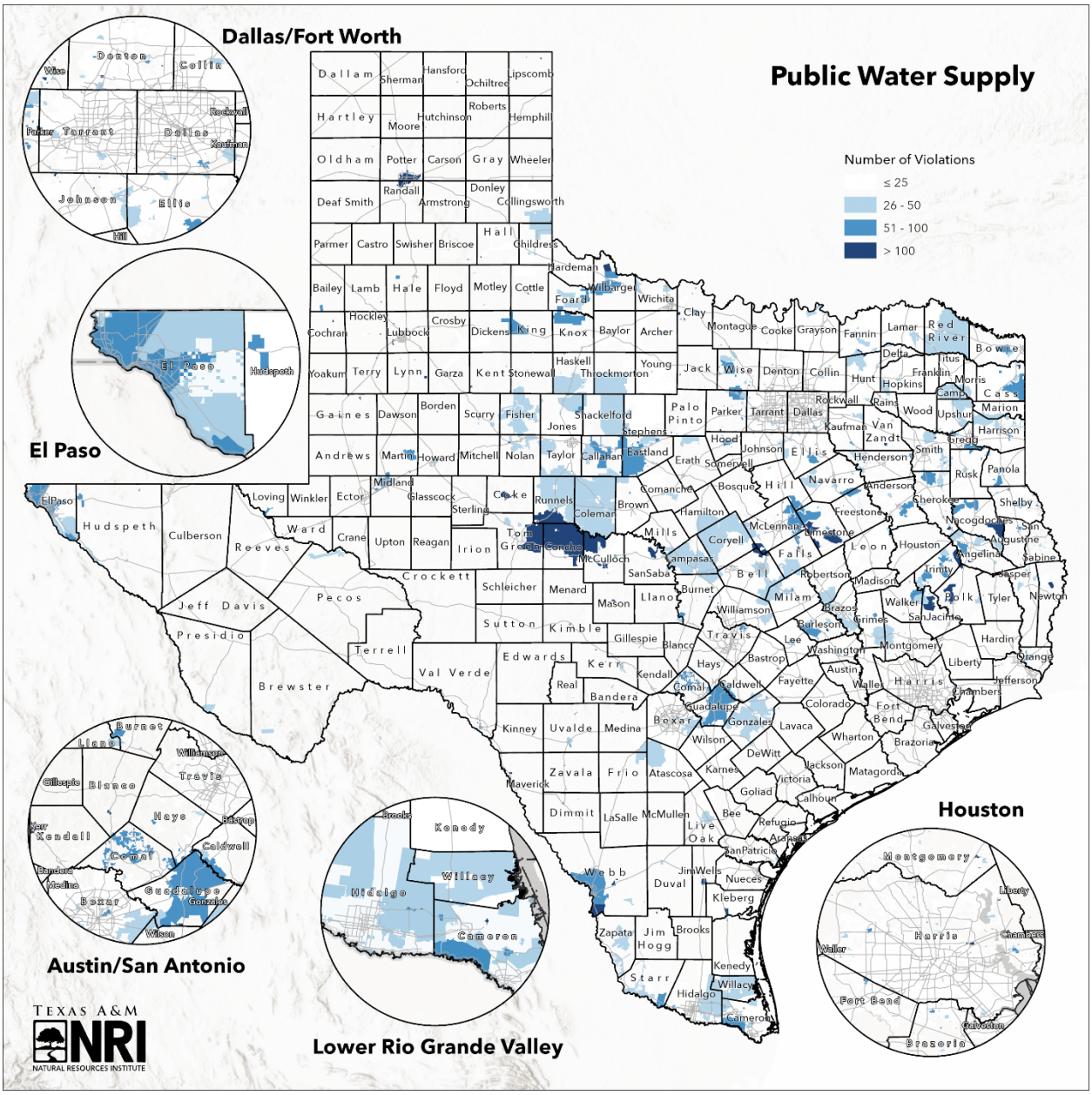


Figure 37. Drinking water violations of public water suppliers in Texas. Source: Environmental Protection Agency (EPA) Safe Drinking Water Information System (SDWIS).

For groundwater, we can look at TCEQ's list of Groundwater Contamination sites as an indicator of potential groundwater contamination in nearby areas (Figure 38). Oil and gas byproducts were the most common contaminants. These include diesel, gasoline, benzene, and petroleum. The TCEQ list only includes reported Groundwater Contamination sites, which ignores contamination in private wells that has not yet been reported. Locations of sites that might pose water quality problems, such as injection wells and superfund sites, are mapped below (Figure 39).

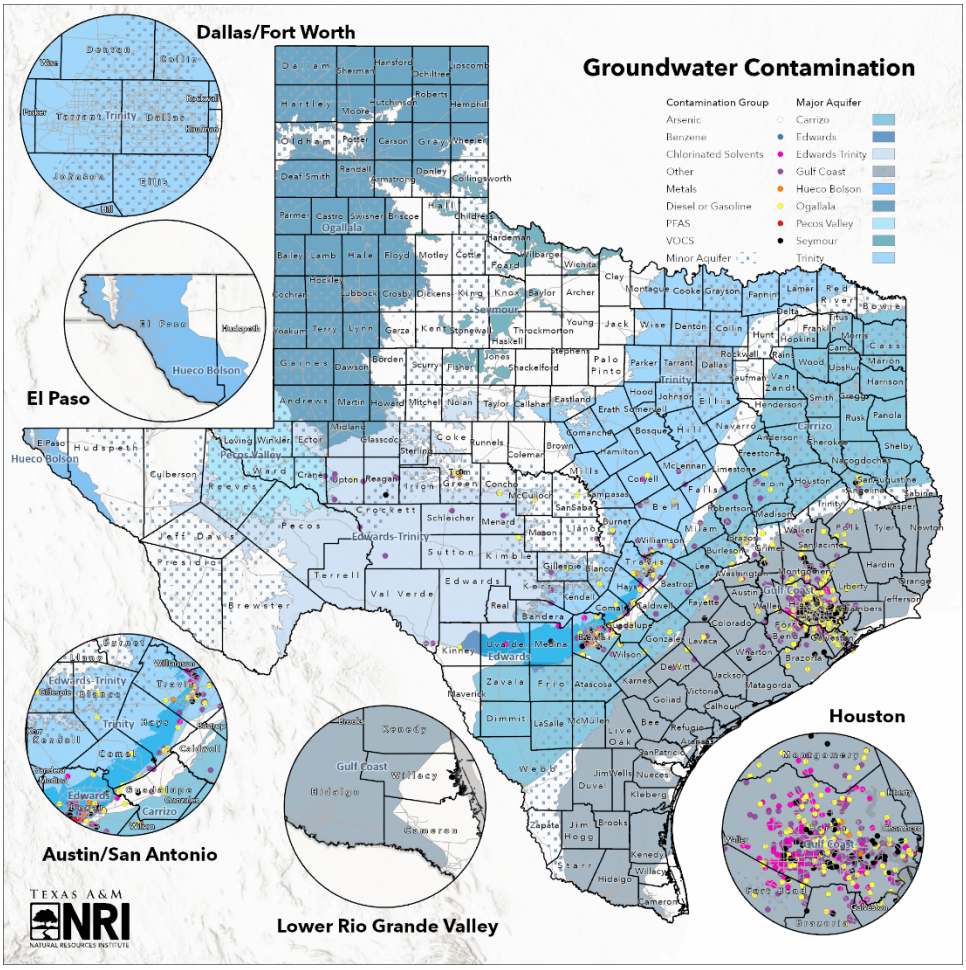


Figure 38. Groundwater contamination sites and local aquifers in Texas. Source: Texas Commission on Environmental Quality (TCEQ).

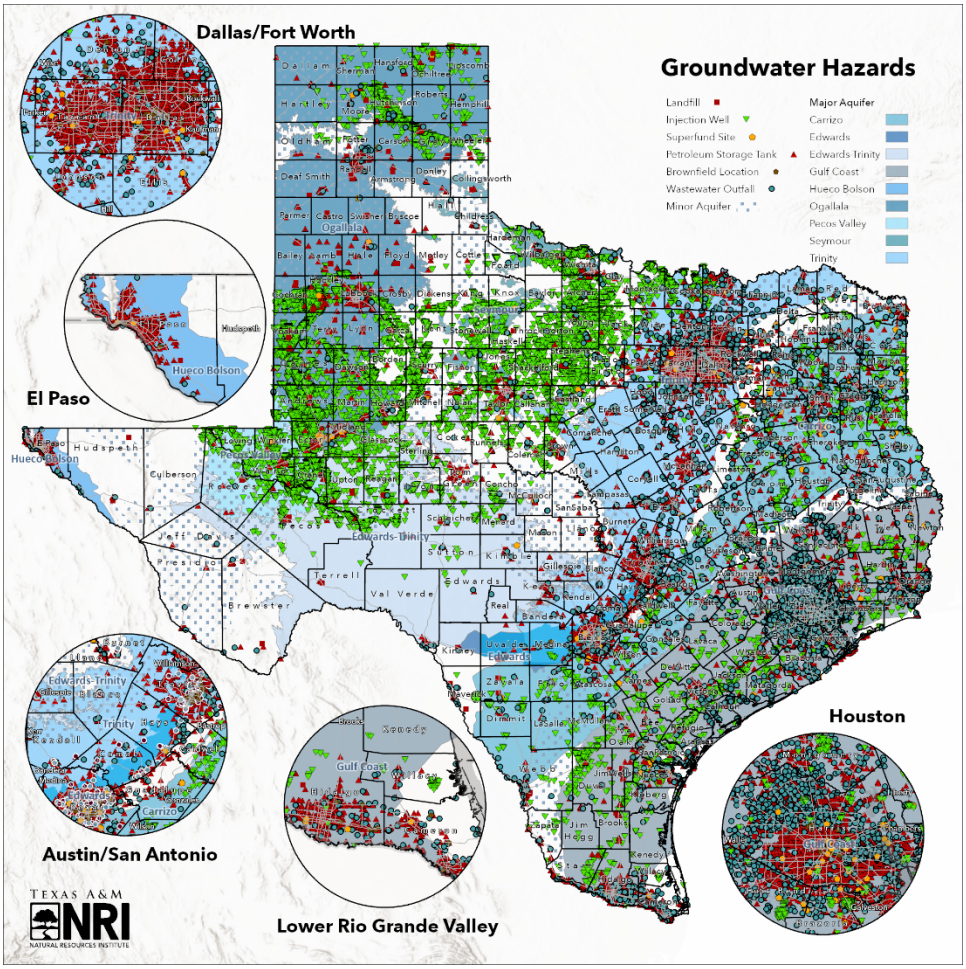


Figure 39. Potential groundwater quality hazards and local aquifers in Texas. Source: Texas Commission on Environmental Quality (TCEQ).

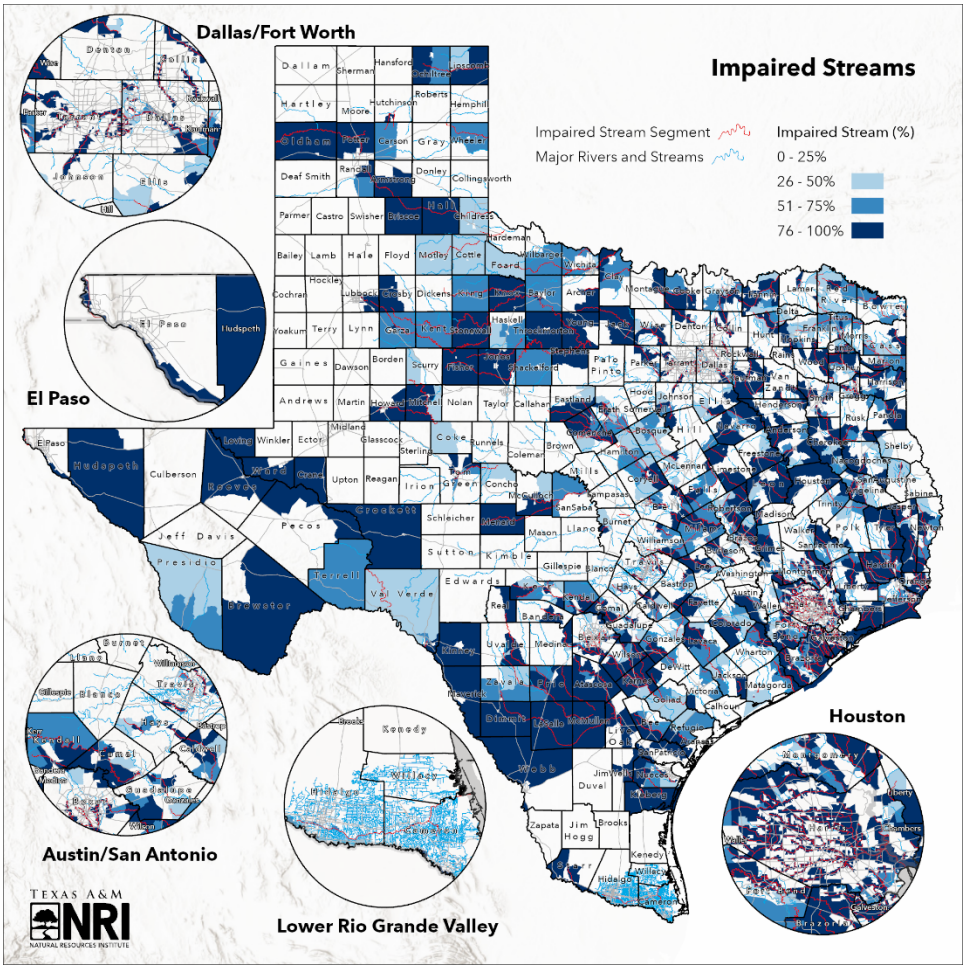


Figure 40. Impaired streams in Texas. Source: Texas Commission on Environmental Quality (TCEQ).

Water pollution can also impact the waterways where people recreate. TCEQ records of Impaired Streams offer some indication of where waterways are polluted (Figure 40). However, the current map of Impaired Streams ignores some streams and rivers that are impacted by excessive effluent exceedances, as is the case in the Llano River outside of Junction (Figure 41).

Austin, San Antonio and Houston show the concentrated patterns of groundwater contamination. Potential groundwater hazards cover the state. There are also many impaired streams and many days with effluent exceedances in or around major population hubs.

Additionally, many rural towns have high numbers of drinking water violations and many days with effluent exceedances. This seems to be more prevalent in the eastern portion of the state. This might signal a need for infrastructure upgrades to drinking water treatment plants and wastewater treatment facilities.

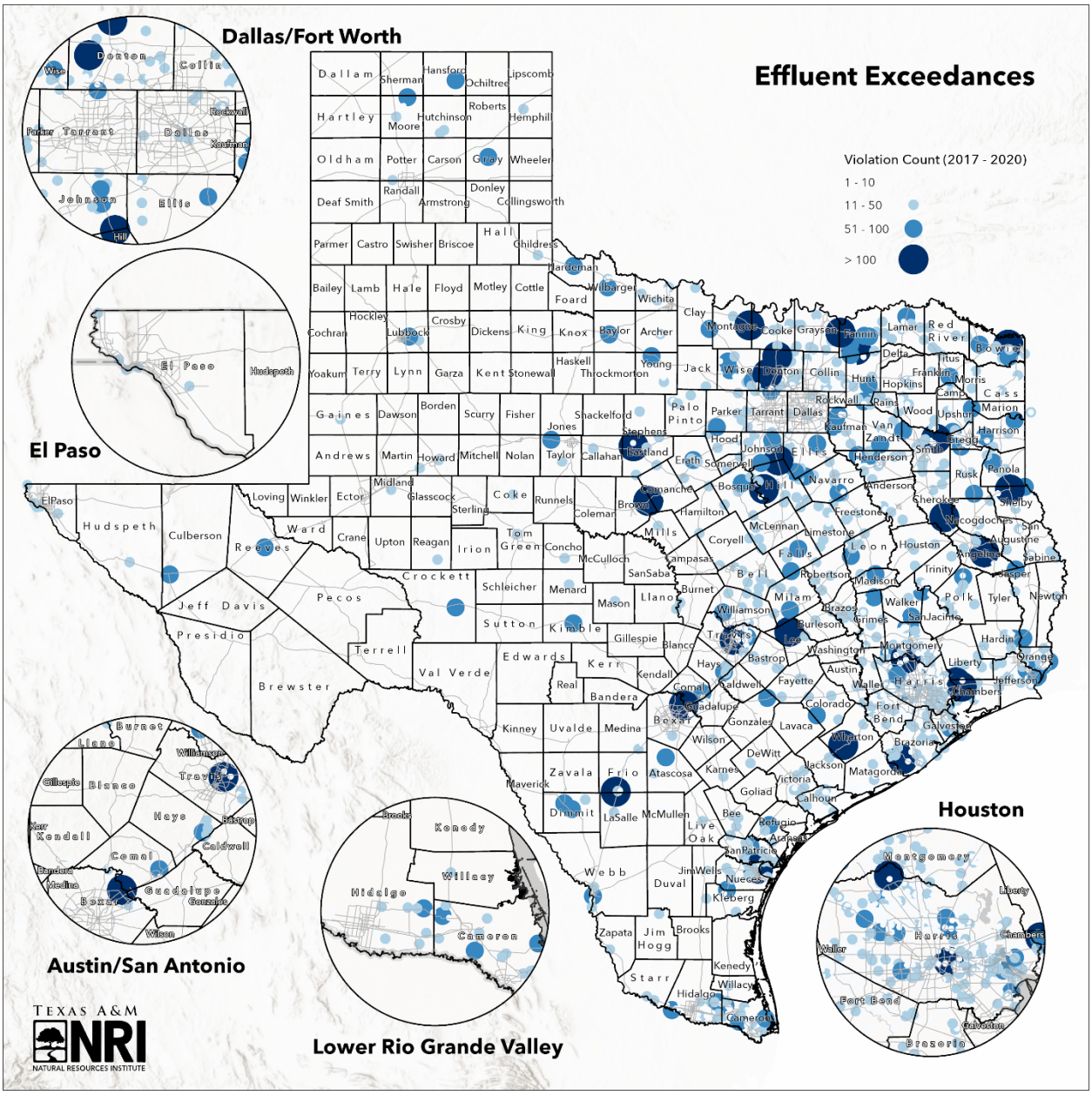


Figure 41. Facilities with excessive effluent exceedances in Texas. Source: Texas Commission on Environmental Quality (TCEQ).

Water Affordability

Water Affordability appears to be an issue in most cities and towns with public water systems. 28% of households under a public water system are at a level of burden that is considered "High" or "Very High"; it jumps to 53% when adding "Moderately High" top the list (Figure 42).

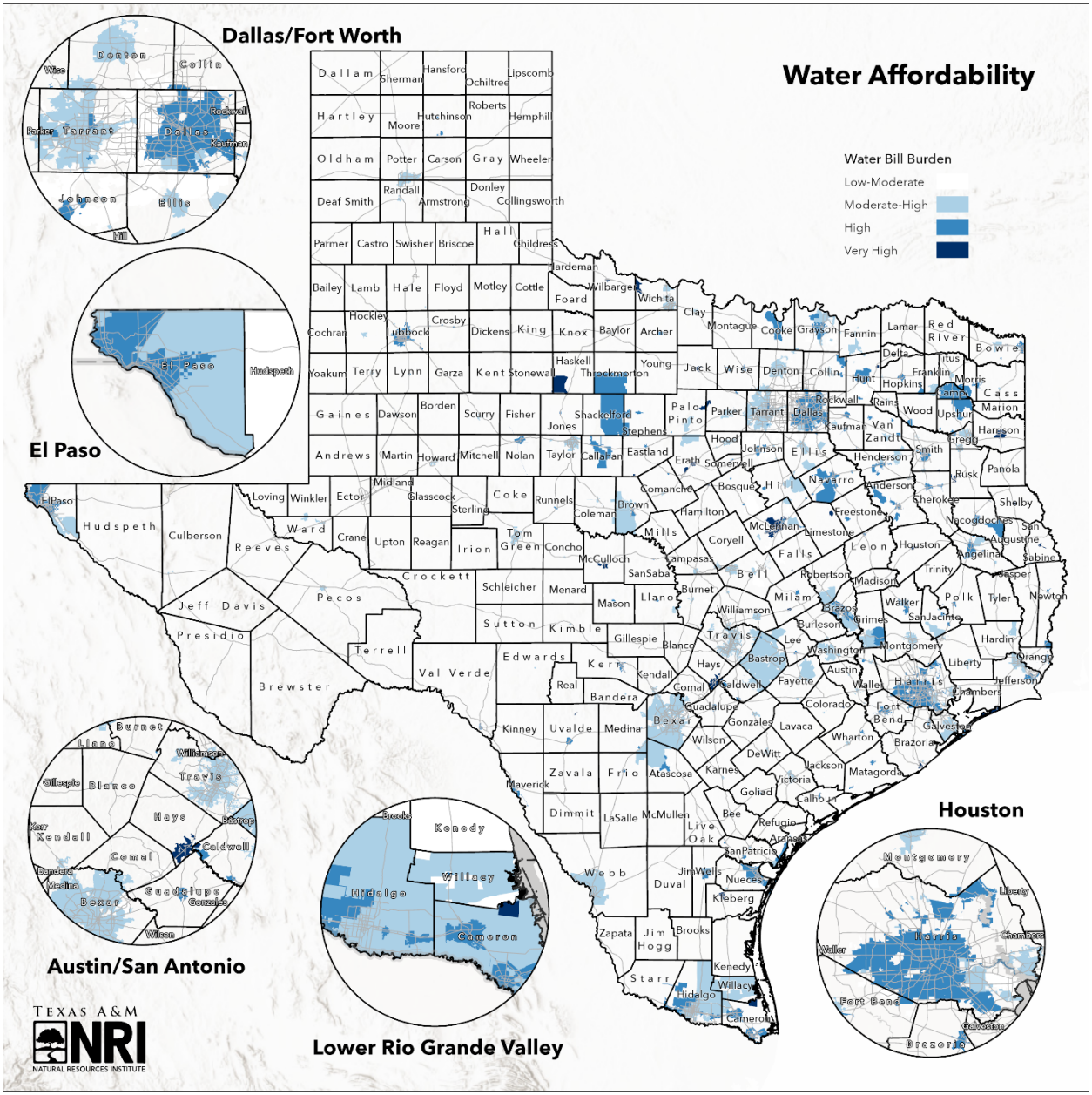


Figure 42. Water bill burden levels for public water systems in Texas. Source: The Nicholas Institute for Environmental Policy Solutions.

Water affordability burden levels are derived from the Nicholas Institute's Water Affordability Dashboard, which calculates an affordability burden from a combination of utility rate data and resident characteristics, such as percent low income, for most public water systems in Texas.

For example, within the San Marcos water utility service area, it would take 21.8 minimum wage working hours to pay for a monthly water bill of 8,000 gallons. Because 44% of people living in that service area are considered low income, the burden level of that water bill is "Very High". In Kerrville, an area where the water affordability burden is "High", it would take 16.2 hours to pay for a monthly water bill for 8,000 gallons, and 37.6% of residents in the service area are considered low income. This assessment assumed an average household water usage of 8,000 gallons per month because according to TWDB, the average monthly household water use is between 7,380 and 7,626 gallons. However, it is important to note that at much lower water usage, such as 4,000 gallons per month, Concan, Llano, Uvalde, and Devine still are considered to have "High" water burdens.

Flood Risk

Flash Flood Alley has a greater risk of flash flooding than most areas in the United States (LCRA 2022). Texas, on average, has the highest death rate from flash flooding annually. A flood hazard index was created based on soil properties, flood zones and flash flood count and displayed below (Figure 43).

The index map below shows flood risk based on soil properties and reported flash floods by county from 1986-2018. Flood risk is highest in counties at the base of the Texas Hill Country (Figure 44).

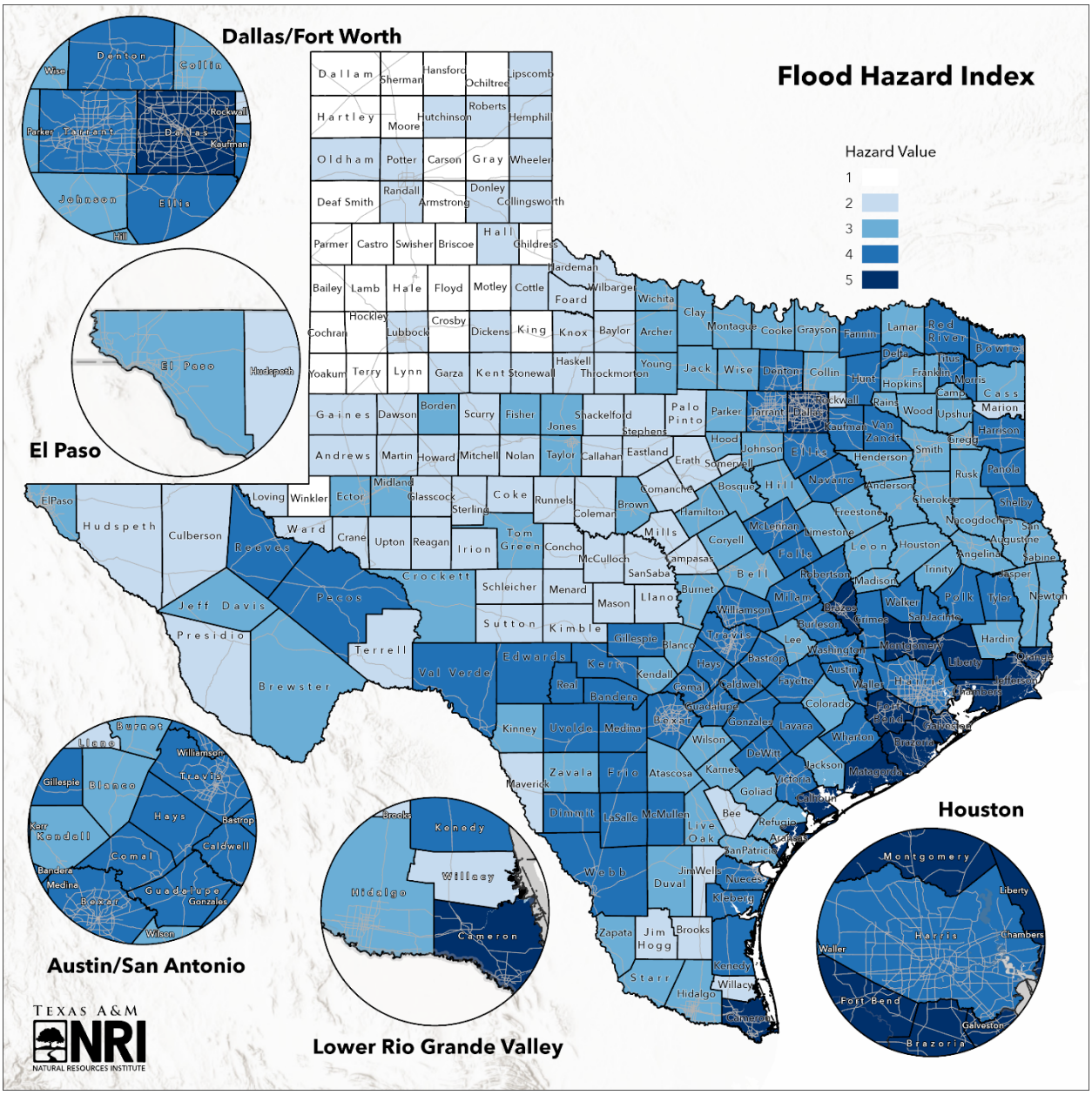


Figure 43. Flood hazard index by county in Texas. Sources: Natural Resources Conservation Service (NRCS), National Oceanic and Atmospheric Administration (NOAA).

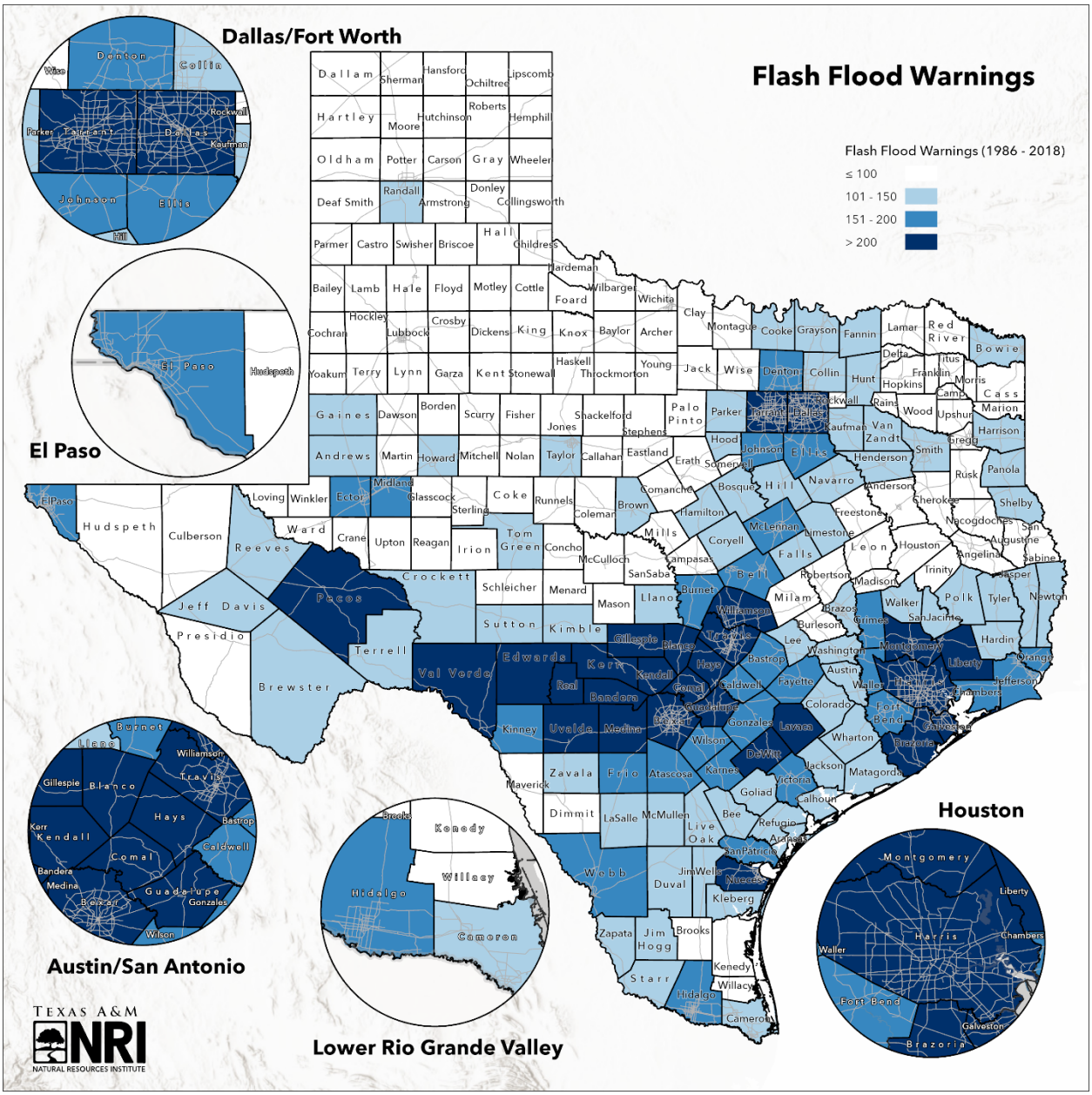


Figure 44. Relative flood risk in Texas using flash flood warnings from 1986-2018 by county and 100-year flood event risk zones. Source: Texas Water Development Board (TWDB).

Water Recreation

Public lands make up a small part of all land in Texas. Most land is privately owned, providing limited opportunities for recreation on public lands and waterways. The top two counties with the most public land are Aransas and Sabine (Figure 45).

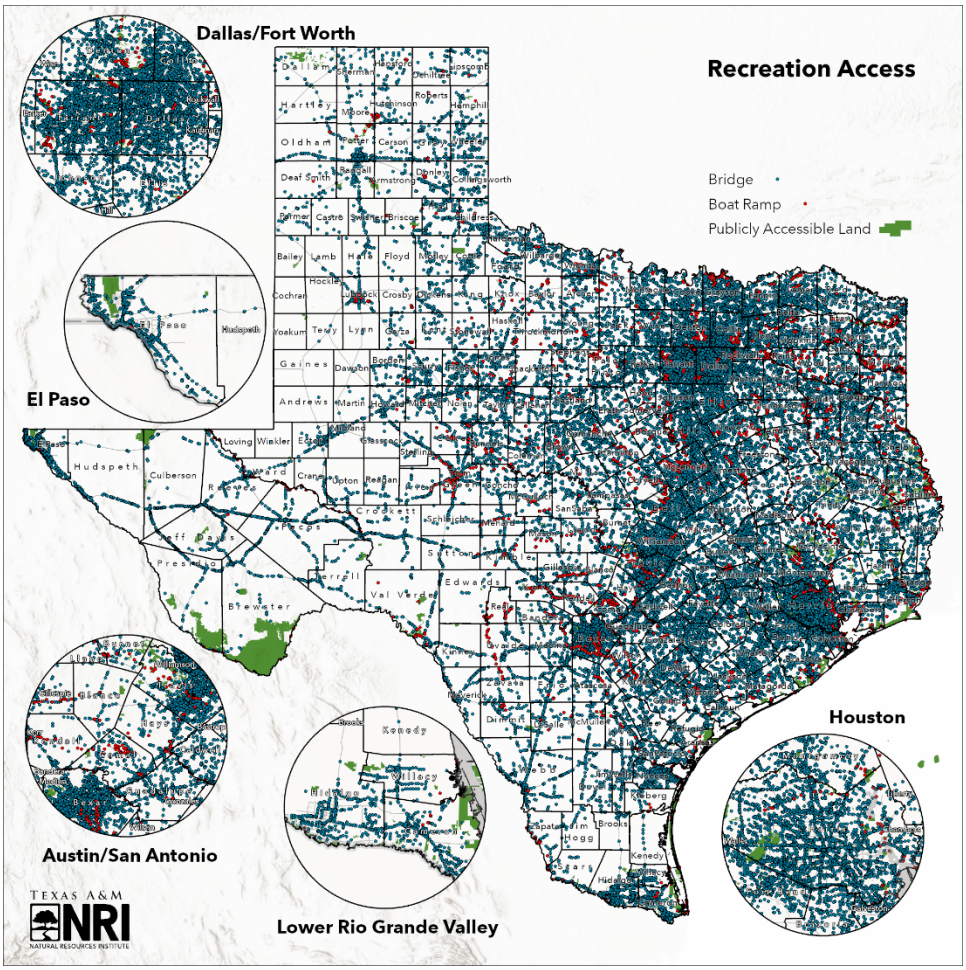


Figure 45. Recreational water access in Texas, including publicly accessible land, boat ramps, and bridges. Source: Texas Parks and Wildlife Department (TPWD), Texas Department of Public Transportation (TXDOT).

Bridge crossings can provide access to waterways in areas without public lands. However, the quality of the waterway at the bridge crossing and access to the bridge itself is difficult to ascertain from a map of bridges in the region. Boat ramps also provide access to waterways. As a general observation, more rural and less populous counties appear to have less access to waterways for recreation.

Housing Affordability

Housing affordability can also be a factor for Communities At-Risk. Recent trends in real estate market value and direction of land development appear to avoid areas where Communities At-Risk are located (see Figure 2). This may accentuate potential environmental challenges for Communities At-Risk where choices to live in more desirable areas may be cost prohibitive.

Water Equityscape

We identified Communities At-Risk (see note for definition in Introduction) potentially subject to environmental challenges in Section 1 of this report through the review of three commonly used vulnerability indices. That effort resulted in the identification of key focus areas where Communities At-Risk may be subject to a disproportionate level of water challenges (Figure 46). In general, there was congruence between the indices and identified areas around the larger urban centers, such as Dallas and Houston. Additional areas, such as the Lower Rio Grande Valley, were also identified as Communities At-Risk. One shortcoming of these vulnerability indices previously mentioned is they do not include a significant number of water-related factors in their calculations. Further, census data used to create these indices may be lacking in some parts of the state.

Following that review, in Section 2 of this report we attempted to remediate the lack of water-related factors in vulnerable community mapping. This resulted in the collection of several important water-related concerns or factors likely to impact Communities At-Risk. Such water challenges included drinking water violations, water affordability, projected aquifer water level declines, flood zone risks, and impaired water bodies (Figure 47). In combining these geospatial layers to Communities At-Risk, we created a “water equityscape” as a planning tool for the EDF. Mapping the nexus of Communities At-Risk with water challenges can aid in targeted programming and water improvement projects to benefit these disadvantaged communities (Figure 48). Due to limitations of data resolution previously mentioned, this mapping approach may miss some communities, however, it can be beneficial to EDF in understanding these issues.

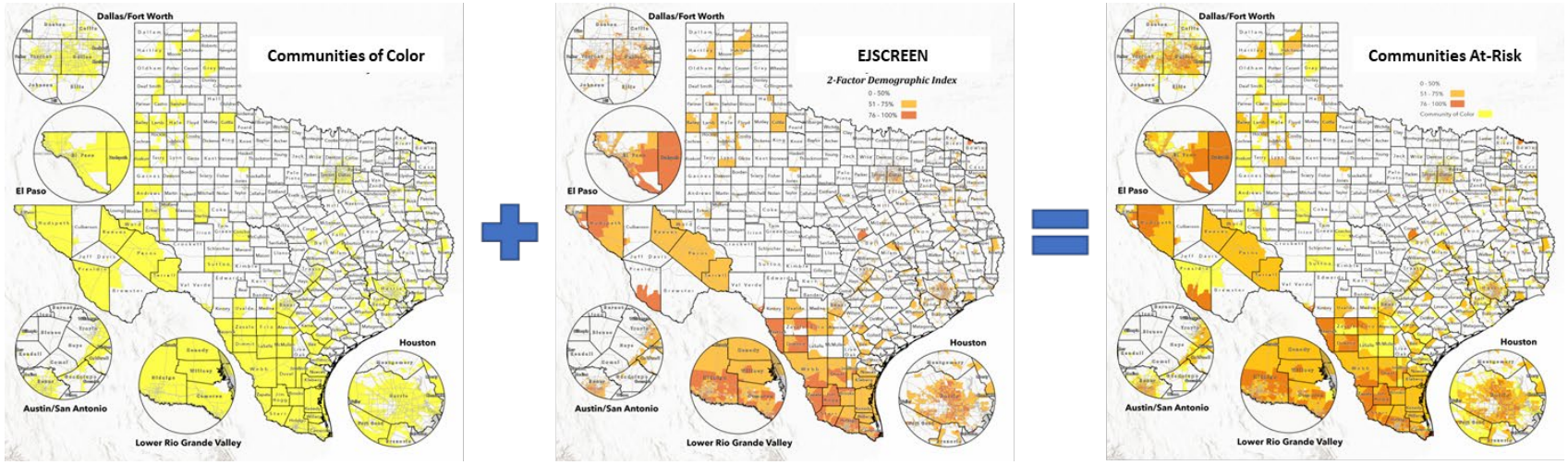
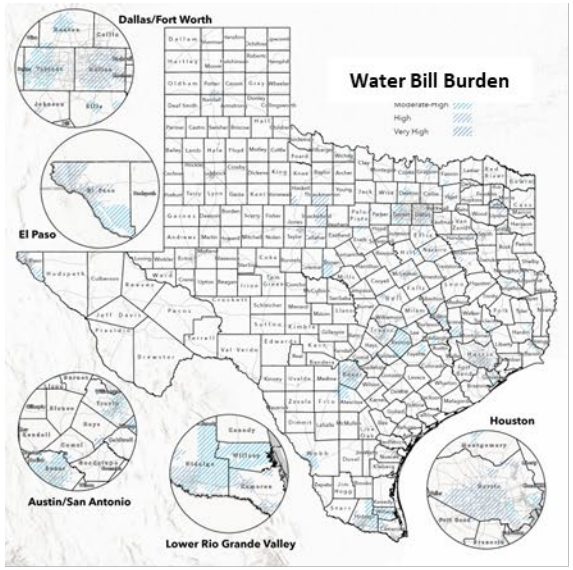
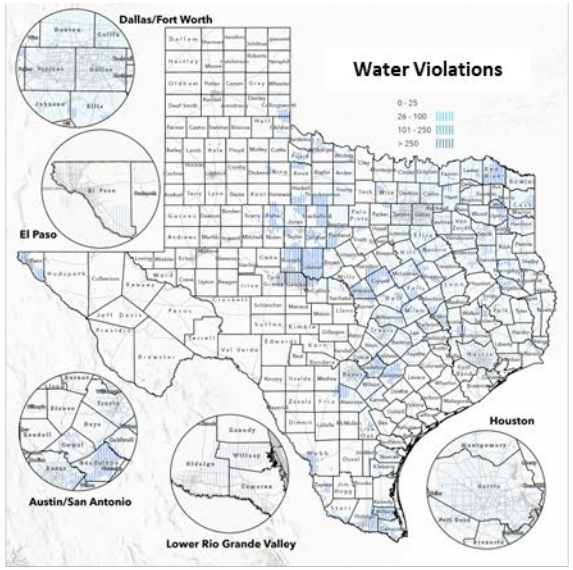
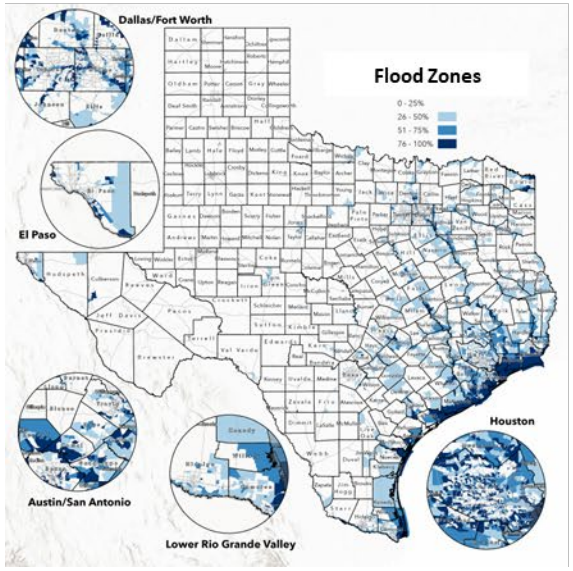
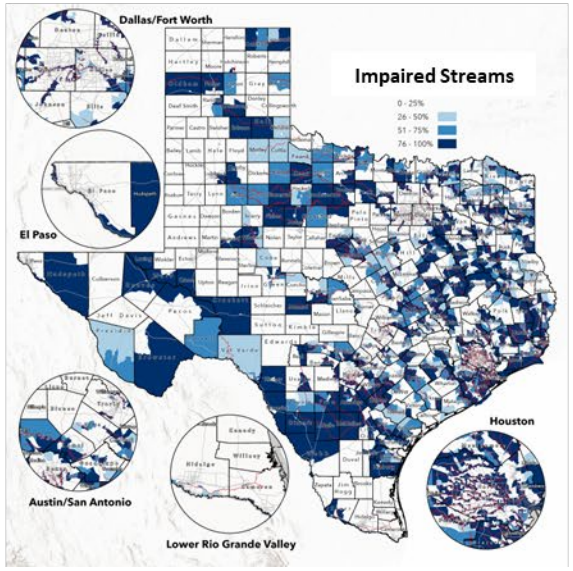


Figure 46. Communities At-Risk in Texas. Source: U.S. Census Bureau, Environmental Protection Agency (EPA) EJSCREEN.


Dallas/Fort Worth
Water Bill Burden
moderate-High
High
Very High
El Paso
Houston
Austin/San Antonio
Lower Rio Grande Valley


Dallas/Fort Worth
Water Violations
0 - 25
26 - 100
101 - 250
> 250
El Paso
Houston
Austin/San Antonio
Lower Rio Grande Valley


Dallas/Fort Worth
Flood Zones
0 - 25%
26 - 50%
51 - 75%
76 - 100%
El Paso
Houston
Austin/San Antonio
Lower Rio Grande Valley


Dallas/Fort Worth
Impaired Streams
0 - 25%
26 - 50%
51 - 75%
76 - 100%
El Paso
Houston
Austin/San Antonio
Lower Rio Grande Valley

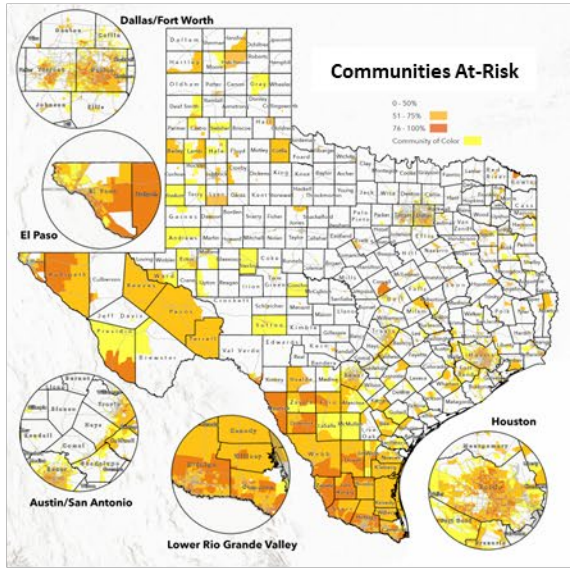

Dallas/Fort Worth
Communities At-Risk
0 - 50%
51 - 75%
76 - 100%
Community of Color
El Paso
Houston
Austin/San Antonio
Lower Rio Grande Valley

Figure 47. Select water challenges or concerns impacting Communities At-Risk. Source: Compiled by NRI from Texas Commission on Environmental Quality (TCEQ), Texas Water Development Boad (TWDB), The Nicholas Institute, Environmental Protection Agency (EPA), U.S. Census Bureau.

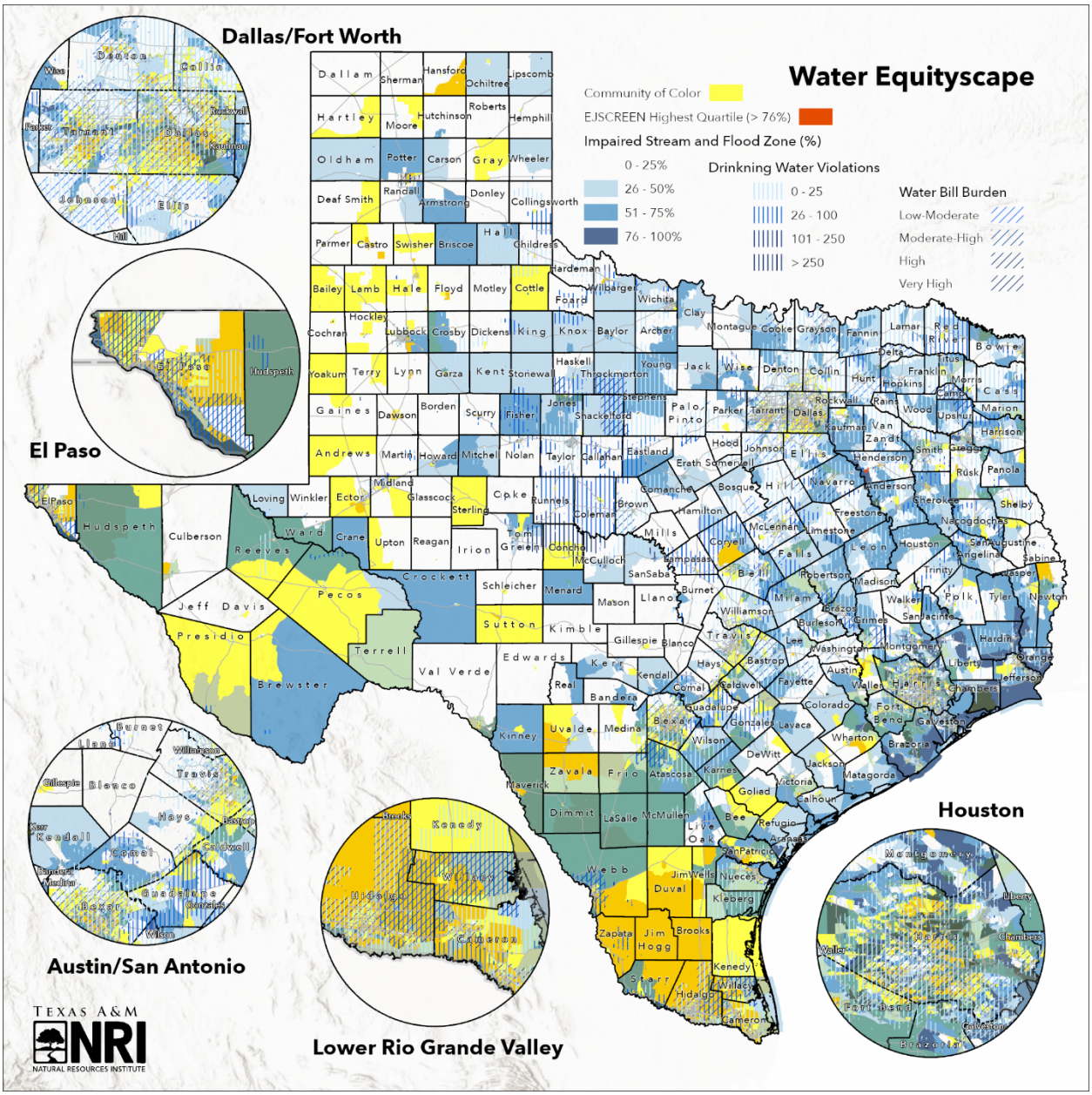


Figure 48. Water Equityscape combining Communities At-Risk and water challenges in Texas. Source: Compiled by NRI from Texas Commission on Environmental Quality (TCEQ), Texas Water Development Boad (TWDB), The Nicholas Institute, Environmental Protection Agency (EPA), U.S. Census Bureau.

Key Take-Aways

- Pressure and demand for water resources will only continue to increase in the coming years for the state in both urban and rural areas. It will be a significant social, economic and demographic issue, defined by specific parameters such as water supply, water quality, flood risk, affordability and accessibility.
- The location of many water challenges is primarily found in and around urban centers. The nexus or overlap of water challenges and Communities At-Risk are identified in key areas across the state.
- Action: Development of a water equityscape map demonstrates the overlap with Communities At-Risk indices and water challenges. Data suggest that Communities At-Risk are exposed to these challenges in some cases at a disproportionate rate. EDF can use this approach to identify high-priority areas in programming and engagement efforts. Further mapping at higher or more local resolutions may be beneficial in future efforts.

Section 3: Water Survey in Texas

Overview

Survey description

The Texas Water Survey was developed to determine daily use and management of water resources and results from the survey were used to assess water use and management across the state. Target audiences included (1) water users (anyone who lives in Texas who uses any water source, such as public or private utility water, groundwater – well water, surface water – river, stream, lake), (2) water providers (someone who works for private or public water utilities, water distributors, groundwater conservation districts, or other types of water providers), (3) community leaders (e.g., elected or non-elected officials, community advocates, county commissioners, mayors, social workers, health professionals, educators, water planners, TWDB regional water planning groups, river authorities), and (4) water professionals (e.g., water utility workers, TCEQ professionals, plumbers, groundwater well drillers). The voluntary survey was anonymous and disseminated through an online survey platform (i.e., Survey Monkey). Survey responses were not associated with those who participated, and results were presented in aggregate form (averages and totals). The mostly multiple-choice survey covered a variety of topics (i.e., general water questions, water dependability, accessibility of information, cost of water, future water needs, water quality, water recreation, private wells, flooding and drought, and water users).

The Texas Landowner Survey, which is released every 5 years by NRI's Texas Land Trends program, is an anonymous and confidential survey seeking to understand private landowner needs and concerns in operating and managing their land. The survey covers a variety of topics ranging from land management, land loss and fragmentation, and landowner challenges and preferences, all of which serve to build on efforts in private land conservation and management. Based on responses from 5 years ago, the Texas Landowner Survey was expanded to include several additional topics, among them water. The survey was disseminated via an online survey platform (i.e., Survey Monkey), and results were presented in aggregate form (averages and totals) and were used to assess water use and management on working lands across the state.

From a water equity perspective, information, dependability, and accessibility were considered drivers of change and assessed. Equity, for this project, is actively defined as individuals meeting their water and water associated needs, since water, although common, is a basic resource needed by all Texas residents. Areas with limited water resources and uses were also interviewed. The survey was reviewed and approved by the funder and funding committee consisting of various water experts and reviewed by the Texas A&M Institutional Review Board.

Response results

Statewide, via the Texas Water Survey and the Texas Landowner Survey, we collected 2487 responses from both surveys with representation from 212 counties. Respondent demographics include 61 years as average age, majority male (78%) and Non-Hispanic White (94%). As expected, responses from underrepresented groups in the online survey were low (6%) and more targeted in-person surveys were conducted to further expand collected information. Target audience make-up included water users (64%), water professionals (19%), community representatives (8%), and water providers (10%). Within these target audience groups, mayors/elected officials, groundwater district managers, TWDB regional planning group members, public water utility providers, and rural homeowners/landowners were the majority within their respective user groups. Water user respondents consisted of rural and non-rural households. The majority of responses (78%) indicated a water provider was present in their community. Question responses (42) were summarized via word clouds (also known as text clouds or tag clouds) with frequent responses appearing in bigger and bolder font colors and sizes to indicate more prevalent or important concerns or needs. Survey data were summarized by category to include water uses, groundwater management, water concerns, dependability, and access.

Engaging with underrepresented groups was challenging using web-based survey tools. For this reason, in addition to the above surveys, 38 in-person interviews were conducted as a supplemental measure to validate and/or further clarify water responses for Communities At-Risk (see note for definition at end of section). In-person interviews with individuals and those familiar with community water-related needs assisted our assessment of community water needs, concerns, and challenges (29 people of color and 9 non-Hispanic Whites).

Responses

Water Uses

Online Survey

Understanding primary water uses can serve in guiding future programs. A series of questions were asked to better describe common water uses by the various survey groups. From survey responses, the primary water source reported by survey respondents included private well and public water utility. This dependency on groundwater will continue to be a future challenge across the state, requiring increased efforts to improve overall water use efficiency, conservation related measures, as well as quality. Other sources of water reported in the survey included surface water, the recapture of rainwater, gray water and water delivery. Drinking and personal, and household water uses were the most common uses across all respondent groups and water sources. For landowner and water user groups, household, wildlife, and gardening followed as the most common water uses. Additionally, both groups used water for many similar purposes: ranching, livestock, landscaping, and other agricultural purposes. Community leaders and water professionals reported gardening and landscaping as

the top water uses, followed by drinking and personal uses. Within an oversight capacity, leaders (community and water) and water professionals reported providing input for domestic, drinking, agricultural, landscaping and livestock water uses. Specific to surface water sources, wildlife, livestock and ranching were attributed as primary uses by landowners and water users. Private wells were primarily used for drinking and personal, household, gardening, and landscape uses, while rainwater was used primarily for gardening, landscaping, wildlife, and livestock. Water delivery was primarily used for drinking and personal, household, and gardening by landowners and for drinking and personal, commercial, irrigation, gardening, household and landscaping by water users (more supplemental uses). Finally, other sources of water, to include graywater were used primarily by landowners for landscaping, irrigation, and gardening, and other water sources, to include gray water by water users, for drinking and personal, ranching and wildlife, and livestock. Community and water leaders/professionals reported access to affordable drinking water, public access to recreational waters, protecting private rights of well owners and sustaining water bodies for recreation and wildlife as priority areas, and these were in line with water user and landowner key community priorities (see questions and responses below).

In-person Interviews

Various sources of water are used across Texas. Some key messages obtained through the in-person interviews emphasized the notion that water uses varied by water source: one-time use water bottles and refillable water bottles, private wells, ponds, recycled water, surface water/river water for irrigation and industry, recycled water for apartment complexes, public and private water utility companies, water dispensers/vendors, bottled water, and captured rainwater for landscaping and gardening are some examples. Water was used to meet primary health needs, cooking needs, followed by household, lawn and garden, pets and agricultural needs. A common theme regarding water use was a general appreciation for water and the importance of its stewardship. There was a desire for users to conserve water and for an increase in meaningful water conservation education programming, along with a consideration for populations that do not have access to water for basic use, such as the elderly and disabled (i.e., water delivery service and transportation services, meals on wheels, etc.).

Regarding water use, a specific concern was rapid population growth impacting water needs across Texas. Rapid population growth is a concern as this will increase water use across all sectors. Finally, water safety fears by way of boil notices are fears that persist, along with fears of inadequate infrastructure. These concerns increased use of bottled water for drinking and household activities, thus are an increased cost to some communities, particularly those that can least afford to purchase outside drinking water. Colonias in particular do not have reliable access to water and their limited use of water has impacted community health and well-being.

Summary

Private well maintenance, drought and ground water resources will continue to be a challenge for Texas. Increasing conservation efforts with water users can serve to improve the long-term sustainability of this finite resource. In comparing attitudes and behaviors between the in-

person interviews versus online survey respondents, other program recommendations may include an increased emphasis in programs focused on private water wells and conservation behaviors and incentives. Water quality was a significant concern for interviewed respondents, and this impacted water use directly. There was also an interest in families that depend solely on bottled water for survival year-round, that programs be developed to ensure they have access to water during weather emergencies or pandemic times (when general public overbuys) and for neighborhood type programs that would ensure access to water for the elderly and disabled.

What are your top three water sources? What are your communities top three water sources?	As a public servant, over which water uses do you provide input for your community?
	

What are your top three water uses? What are your communities top three water uses?	If you were planning for the future water needs of your community, how would you prioritize the various water uses below?
	

What are your top three uses for water utility?	What are your top three uses for surface water? What are your communities top three uses for surface water?
	

What are your top three uses for private wells? What are your communities top three uses for private wells?	What are your top three uses for rainwater? What are your communities top three uses for rainwater?
	

What are your top three uses for graywater?
What are your communities top three uses for graywater?

Ground Water Management

Online Survey

A key aspect of the statewide study was to better understand the use and impacts to groundwater resources. A series of questions focused on this aspect of water management to include the question of what percent of residents have active private wells. In general, the majority of landowner respondents (59%) reported having an active private well for drinking and personal, household, gardening, landscaping and ranching uses (16% of landowners received water from a water utility). Approximately 34% of water users respondents reported having active wells for similar uses (45% received water from a water utility). Along with active wells, survey respondents also had inactive wells on their property. Some respondents had both active and inactive wells. These comprised 5% and 8% of Texas Water Survey respondents respectively. Both Survey respondents felt that private well water quality was primarily the responsibility of the well owner, their local Groundwater Conservation District, everyone above the aquifer recharge zone area and landowners surrounding the well. In terms of well checking frequency primarily related to maintenance of well equipment, 60% of water users checked their wells 1-3 times per year, 6% checked their wells 4-6 times per year, 17% checked their wells > 6 times per year, and 17% did not check their well because it was too expensive to fix. If issues with private wells, such as maintenance or other water quality challenges were experienced, these were typically addressed through engagement with a private well maintenance provider or in correspondence with their local Groundwater Conservation District representative. Respondents were asked if their wells had gone dry at any time in the last 5 years, and 10% reported their wells had gone dry.

In-person Interviews

Respondents felt that groundwater resources were important and were vulnerable due to rapid growth across Texas. Water wells were expensive and out of reach for some communities.

Summary

Water users across Texas have a high reliance on groundwater resources and as previously mentioned, increasing conservation efforts can improve the long-term sustainability of water supplies. The importance of Groundwater Conservation Districts and private well owners in managing groundwater supplies were recognized. In comparing attitudes and behaviors between the in-person interviews versus online survey respondents, other program recommendations include programs focused on education, well maintenance and water conservation.

Who is responsible for water quality of wells?	When you or your community's residents need assistance with your well, who do you contact?
	

Water Concerns

Online Survey

Water concerns reported in the survey included water availability, drought, water quality, ground water, and affordability. These were identified as the most pressing challenges by all respondent groups. Within this context, when asked about more specific water concerns, drought, water conservation efforts, domestic availability, the health of groundwater, and regulations, among others, were the most pressing specific concerns. A few of the survey questions focused on the management of wastewater landowner property or by the community. Most landowners and water users reported septic systems as part of their wastewater management strategy, followed by graywater reuse, sewer, and surface water. All respondent groups reported no significant wastewater challenges on their properties or in their communities. With respect to ground water and surface water rights ownership, the majority of landowners (>90%) reported ownership of both surface and groundwater rights whereas water user respondents reported owning rights to groundwater and surface water less than 50% of the time or not owning ground or surface water rights. The cost of water can be a limiting factor for communities. Overall water users were somewhat satisfied with current water prices and most respondents tried to remain somewhat neutral with their responses. Most respondents agree that households spend 10% or less of their household income on water. Community leaders and water professionals had a wider range of responses describing water user household income spent on water. Water users describe how some expend at least half their household income on water, and their responses ranged from “none” of their income towards water expenses, “10% or less”, to greater than 11% of their household income. Water providers felt water users spent up to 10% of their household income on water. Community leaders and water professionals felt businesses expended up to 40% to 50% on water, and water providers estimated water expenditures for businesses were closer to 20%. Trust in the quality of drinking water across communities was high (78%) across all groups. Finally, when asked about experience with flood and drought damages, most respondents indicated impacts due to flooding (64% water user, 87% community leader, 74% water provider, and 75% water professional) and drought (79% water user, 95% community leader, 67% water provider, and 94% water professional) collectively.

In-person Interviews

Based on in-person interviews, there were many expressed water concerns centering around access, water quality, safety of consumable water, infrastructure improvements, water conservation and drought, communication along with planning for future water needs. Communities with significant water needs wanted community leaders, water providers and water professionals to understand that their decisions directly impact their families and their health. They wish to express that their and all communities and families matter, their children’s health matters, as they all have been irreparably harmed by deficient water quality. Their plea is not only for their families, but for all families. Water conservation is important to these communities to meet future needs of their and all families. Most noted there was only one water provider, and despite the lesser quality of water they received from the provider, even if the water was not consumable, respondents were still responsible for 100% of the bill, and this

occurred over many years. They are requesting water providers be accountable as they are accountable for paying their bills. Improved communication between water providers and respondents was also expressed.

Respondents who had access to water shared concerns regarding conservation as well, along with ensuring that those that do not have access to water are provided with needed water. Future water use and conservation programs were important to all respondents

Summary

Drought, water availability and water conservation are significant concerns across survey groups for the Texas Hill Country. Cost of water and water quality were primary concerns, along with infrastructure and its association with water quality. Improved communication was requested. Trust was eroded when water quality decreased, and the longer water quality was a challenge, trust decreased as well. In comparing attitudes and behaviors between the in-person interviews versus online survey respondents, other program recommendations include programs focused on water conservation, drought, and future water availability.

Thinking only about your property, please select your 3 most pressing (general) water concerns.	Thinking only about your property, please select your 3 most pressing (specific) water concerns
	

How do you manage wastewater on your property or in your community?

Dependability and Access

Online Survey

The dependability and access to water resources are potentially at the crux of water equity challenges. In the final section of the water and landowner surveys, we asked a series of questions to determine the perspective of survey respondents to dependable water supplies as well as access to water supplies and recreational opportunities. In this section we also determined access to information regarding water resources provided by various water-oriented entities such as water public utilities or Groundwater Conservation Districts.

Water Dependability.—As noted in the previous section, water availability is viewed as a high priority issue across the state. In asking what makes water dependability a challenge, water availability was the primary reason offered followed by high cost, water quality and infrastructure damage as key contributors. In general, most survey respondents felt they had reliable access to drinking water and there was a general satisfaction with the overall dependability of services provided through local water providers, with some exceptions. Community leaders, water professionals and water users noted that not everyone had dependable access to drinking water.

Information Access.—With a few exceptions, the majority of respondents had access to the internet via their cellular telephone (exception: community leader 80%, water professional 85%), and over 90% of respondents had access to a cellular telephone. Conversely, access to landlines was in decline. For water users specifically, slightly less than half had access to a landline, whereas 60-80% of water professionals, community leaders, and water providers had access. Certain types of communication types were favored over others. Despite internet access, more traditional means of communication were favored by water users for receiving water information, such as written media, directly from their water provider or via local traditional media outlets. Community leaders, water professionals and water providers were asked how satisfied they were with their process for receiving water information from their respective communities. Most said they were satisfied with the processes they had set in place for receiving information, with some exceptions. Community leaders and water professionals displayed more neutral responses and indicated slightly more dissatisfaction than water providers. When water users were asked their level of satisfaction with relaying water information, they indicated satisfaction but with slightly more neutral responses and dissatisfied responses. Each respondent group was asked what things made providing water information a challenge for them. Water users provided information sharing constraint examples: trust in information provided and in the source providing the information, not everyone is receiving safety-related information (start boil notice), and some are only receiving outdated safety information (stop boil notice), time constraints, technological constraints (internet connection challenges, system was down or inundated with calls, power outages, unclear who to contact/vagueness of information, office hours not conducive to receiving calls, not knowing who to contact, outdated, limited, inaccurate, or hard to access data, no means of interpreting data, complicated terminology, websites not user friendly, no centralized hub to send information and with current and relevant water information that is updated often with a county-wide structure). In terms of sharing water information, water providers, water

professionals, and community leaders were asked how satisfied they were with the accessibility of the water information they provided to the community. With respect to information accessibility, water providers, water professionals and community leaders felt water users were generally satisfied with the processes they set up for relaying information (provided accessible information), and water users generally agreed, with some exception. Some water users do not access water information from elected officials, from water meetings, from Groundwater Conservation Districts, or from community postings as their preferred sources of information. Broadening information accessibility from these sources would allow for greater communication, knowledge and water participation among broader water user groups. Consideration of the type of information water providers share, the methods employed, the frequency information is shared (to much or too little) and the relevancy of the information are key factors for possibly improving water user reception. Specific suggestion by water users is to avoid relevant, important, and timely water informational mailings look like junk mail (email or postal mail). Language barriers can be a challenge related to access of water information. In our survey, the preferred language for information was English and nearly 60% of water providers offered information in Spanish, compared with 30% for water professionals and community leaders. Water users surveyed preferred to receive information in English (approximately 10% in Spanish). This is likely due to the anticipated bias in collecting the majority of survey responses via the web.

Recreation.—Access to water recreational opportunities was another area measured in our project. An initial question involved recreational activities available in communities. Fishing and biking were the most common activities mentioned, followed by birdwatching, experiencing nature, group sports, swimming in a local pool, photography, and wildlife watching. Respondents were asked how often they frequented bodies of water for recreational purposes. All user groups indicated their communities frequented bodies of water less than once a month. Reflecting anticipated participation levels, less than 10% of water users participated greater than 3 times a month, and almost 20% participated once a month. Reported barriers to recreating in a local body of water were primarily attributed to not enough time for that activity, work schedule, money, no designated access points, not having someone to go with, and places always full. Distance did not seem to be a limiting factor to water access. Most water users traveled less than 10 miles to access a body of water, and participation decreased as distance to the body of water increased. Some participants indicated no personal or public transportation as contributing factors. Finally, survey respondents were asked to rate the overall quality of the water body in which they preferred to recreate. Rating of water quality varied from very good to poor and very poor across all survey groups, with some water users indicating they did not recreate in or near bodies of water.

In-person Interviews

Interviewees provided perspectives regarding single-home residential, large residential, institutional water needs and Colonias. Water dependability was a significant concern for residents with respect to current drought conditions and during weather- and health-related emergencies. Respondents associated with larger residential living areas, such as schools or large occupancy residential spaces, were aware of the privilege bestowed on them for being provided continual water service during weather and health-related emergencies, and these

entities ensured that their doors were open to share their water resources with those in need. These respondents also had concern for others and were acutely aware of the need for conservation practices, which were espoused and promoted by residents. For Colonia residents, water dependability took on a more severe need, one of survival. Colonia development was described as a progression from not having basic water and sewer infrastructure services to having these services installed after a long and arduous process, only to struggle with the reliability of the service (quality of water, safety, cost). As an example, a Colonia resident described water quality experiences where the water was the color of coffee without milk which stained clothing and caused health issues, water sometimes with sediment associated with water utility pipe work that caused small rocks and sediment to settle in the private property's pipes, creating clogs and damaging appliances. Because the home finally had access to a water utility after many years of struggle, despite the water source deemed unsafe to drink and consume, community residents were still required to pay their monthly water bill. Tied to water dependability and access is information. Colonia residents often were unaware their water was unsafe to drink and were surprised to find out via traditional mail delivery, a method which took several days to receive, and during which time, consumption, drinking and use of unsafe water unknowingly occurred. Although reaching water users via traditional mailings can be a successful communication method, caution should be exercised on whether messages relayed are appropriate for such a slow delivery method. Berthold et al (2021a) describe successful direct mailing collaborative campaigns. Given our study findings, we urge caution with the type of information shared via this method, to perhaps supplemental knowledge in layered information campaign efforts and involving more direct, immediate communication as a first contact when safety is a factor. Water dependability and access also was associated with water affordability, as once trust in a water source (dependability, quality, access, safety) was breached, some water users felt it was necessary to purchase more reliable and safer water, in addition to their current water source, even if they could not easily afford the added expense (water as a basic need). This was common across all water user groups (Colonia and non-Colonia residents). Non-Colonia residential respondents noted that water was dependable for their use, except during weather and pandemic times. During these times, water was unsafe to drink for some respondents, and respondents had to purchase available water.

Water recreation participation varied among respondents. Not all respondents were open to water recreation participation, some could not afford to recreate in or near water, and in general associated with costs and work schedules. For example, some participated a handful of times a year, while others participated in water associated activities almost daily. Some residential living spaces provided water recreation opportunities for residents, such as swimming and general water play. Participants had an appreciation for nature.

Regarding communication, respondents that had more reliable access to water felt communication was ample while respondents who did not have a consistent dependable water source or access to water were more likely to mention that water providers would essentially ignore their needs, despite their consistent communication efforts, to the point that only collective community participation would result in forward movement.

Regarding future water conservation and water availability, all respondent groups were interested in water conservation and attempted to conserve water in their own way at home and in their places of businesses. Respondents were very water conscious and very much aware that water was a limited resource.

There was an interest in conservation programs by all respondent groups. Our study findings appear to suggest access to and reliability of information, future water needs and availability, and cost of water might be associated with conservation behaviors and perceived future risks, such as water safety and water quality. These general findings were somewhat similar to Berthold et al (2011b), where risk was associated with risks to future crop yield for growers adopting new water technologies, where many factors were at play. Water is universal and necessary for all Texans, and fears for future water availability and quality, and its direct and indirect impacts, are very real. Combining study fields and continued multi-pronged, collaborative approaches to helping Texans with future water needs may help all communities as we move towards solving future water challenges.

Summary

Water availability in the future appears to be a significant concern across survey groups and a key factor in dependability for water users across the state. The current dependability and quality of water resources, however, remains high across all user groups. Differences in perceived access to water information in terms of format and communication networks can serve to improve programming and outreach. Survey responses likely do not adequately represent underrepresented communities, illustrating the need for alternative approaches in community engagement, such as in person contact and communication. In comparing attitudes and behaviors between the in-person interviews versus online survey respondents, other program recommendations include programs focused on improving water quality, infrastructure, structural and accessibility barriers to water access and water information. Based on interviews, there is a significant lack of access to water, sometimes safe drinking water in areas across the state, specifically along the borderlands. There is also a need to consider cost of water and for improved infrastructure, particularly in areas that may not be able to afford it.

Over the last 5 years, what are some things that have made water dependability a challenge in your community?	How does your community prefer to receive water information?
	

How do you prefer to share water information?	Which recreational activities are available in your community?
	

What are some things that keep community residents from recreating more often in a local body of water ?

Survey Summary by Respondent Group

This section provides a summary of survey responses by respondent group. This allows for a general comparison among respondents. These are generalities and may differ slightly from the top 3 descriptions in the previous section.

Water User

Water user respondents consisted primarily of rural and non-rural households. Their primary water use involved personal, drinking, and domestic uses, and their primary sources were water utilities, private well, and rainwater. Water on their properties was used for drinking, household, gardening, and landscaping. Any surface water on their properties was primarily used for wildlife, livestock and ranching. They had an interest in rainwater capture, which was used for gardening, landscaping, and wildlife. Their greatest specific concerns were drought, water conservation, the health of groundwater and surface water, and contamination. They were mostly satisfied with their water provider and favored water providers, Groundwater Conservation Districts, private water-related repair business for water assistance, and in terms of receiving water information, water users preferred printed media, information directly from water providers, and local traditional media. They had mixed responses about groundwater and surface water ownership, with between 40% to 55% owning the right and approximately 45% not owning the rights. Most water users had septic systems (60%) and some had sewer systems (35%), and none experienced wastewater challenges. They preferred sharing information via in person meetings, community meetings and written media, and they were somewhat satisfied with the cost of water, spending 10% or less on water, although it is important to acknowledge that there are areas across the state with no access to water, safe drinking water, or affordable drinking water. They were somewhat satisfied with the flow of information from water providers and with the process for relaying information to water information sources. Water users preferred information in English, and had access to the internet, with limited access to landlines. Ensuring access to affordable drinking water was their main priority, as they trusted their water source. Wildlife watching, experiencing nature and relaxing by river were their main recreational activities, although they participated in the activity mostly "less than once a month" and less to "greater than 5 times a month." Not enough time (44%), work schedules (21%), not having someone to go with (25%), places too far away (17%), individuals choosing not to recreate in or near bodies of water (15%), and water areas do not look clean (14%) are constraints that limited recreational participation. Most water users traveled less than 10 miles (47%) and between 11 and 25 miles (21%) to a body of water for recreation, and they felt the quality of water at community recreational areas ranged from very poor (3%), poor (8%), average (30%), good (37%), to very good (17%). Many respondents did not have active water wells, and those that did (approximately 30%) sought the assistance of private water well companies for assistance. Well checking varied between 1 to 3 times per year (60%) to greater than 6 times per year (17%). Due to cost constraints associated with fixing wells, some well owners did not check their wells (17%). Approximately 10% of water users with wells reported their wells had gone dry in the last 5 years. Water users felt that they (well owners) were responsible for well water quality. They also felt everyone above the aquifer recharge zone, Groundwater Conservation District, and landowners surrounding the well were partly

responsible for well water quality as well. Most water users had experienced floods and drought damage (64% and 79% respectively) on their properties.

Community Representatives

From the survey results it is clear that water leaders across the state are most concerned about water availability, drought, and water quality. Specifically, water leaders were concerned with the impact of drought, local planning, conservation and water availability for residential areas and domestic needs for their communities. They are very concerned about water quantity challenges stemming from the rapid pace of development and increased groundwater use, leading to decreasing aquifer levels and streamflow. Leaders feel that current groundwater laws (e.g., Rule of Capture) are a huge barrier to sustainable groundwater management. Many expressed frustration that groundwater and surface water are managed separately. On the water quality side, sewage waste, both from failing septic systems and wastewater water treatment plants, was the most common water quality concern. Leaders are concerned about the impact of wastewater effluent on stream quality and missing controls on Nitrogen (N) and Phosphorus (P) pollution. There are also concerns that TCEQ is not sufficiently regulating water quality (i.e., their standards are too lax). Most community leaders (75%) prioritized ensuring access to affordable drinking water as one of their main priorities. Other priorities included ensuring affordable public access to recreational waters (13%), followed by water uses associated with jobs and protecting private property rights of well owners. Community leaders who responded to the survey felt that responsibility for well water quality rested equally on the Groundwater Conservation District and private landowner/owner of the wells. They also felt everyone above the aquifer recharge zone and landowners surrounding the well were partly responsible for well water quality. Many community leaders were satisfied with the cost of water, some were neither satisfied nor dissatisfied with the cost of water, while others were dissatisfied with the cost of water. Water affordability might be a polarizing topic water with some believing water is too affordable, and others that the cost for water should be higher to incentivize conservation. Affordability and access is currently a challenge for some in communities across the state. Community leaders reported water recreation participation took place primarily less than once a month and greater than 5 times a month, with recreational constraints involving not enough time, few access points and places always full, and with a travel distance of less than 10 miles to a body of water. They felt the quality of water at community recreational areas ranged from poor (4%), average (26%), good (35%), to very good (26%).

Water Providers

Water providers who responded to the survey were primarily public entities. They viewed water utilities, surface water, and private wells as a community's primary sources of water. Water providers indicated private wells were active wells (100%), some considered inactive wells existed (83%) and others felt both active and inactive wells were found on properties (57%). Most water providers (87%) believed that private well owners were responsible for well water quality, some that landowners surrounding the well (48%) were responsible, others that everyone above the aquifer recharge zone area (39%) were responsible for well water quality, and an almost equal amount that Groundwater Conservation Districts (35%) were also responsible for well water quality. The primary water uses in communities were for gardening

and landscaping, drinking and household, and irrigation. All felt there were no wastewater challenges, and they were satisfied with their dependability. Water providers identified water dependability challenges as those associated with high cost, water availability, and infrastructure damage inside private properties, while a few believed water dependability was not a challenge. Community water concerns revolved around water availability, quality, affordability, and drought, among others. Access to drinking water and the internet was considered reliable, along with a water provider's accessibility when receiving information from the community. In terms of communication, water providers employed a variety of methods to relay information community, and interestingly, when asked how they preferred to share water information, few selected themselves as a vehicle for water information (Counter to this, water users, a.k.a. the community, listed water providers as their second preferred source for receiving water information.). Water providers shared information with the community in English and described the community as preferring to receive water information via written media, community postings, and from themselves (water providers), local traditional media, and community meetings. According to water providers, communities were satisfied with the water information provided to them. Communities also preferred to share water information with water entities via written and local traditional media, community postings and community meetings (Water users mostly agreed with water providers regarding this sharing of information; they preferred in person, community meetings and written media methods to share water information.). There was a perceived general satisfaction with the cost of water among water providers, where less than 10% of a household's and less than 20% of a business' income was spent on water. A few believed some households and businesses did not pay for water. Most water providers agreed communities trusted their drinking water and prioritized ensuring access to affordable drinking water and water uses associated with local jobs. They also indicated their communities had experienced floods (74%) and droughts (67%), and that private landowners were responsible for their wells. Water providers reported the frequency of water recreation participation was primarily less than once a month, with constraints involving lack of time, limited work schedules, and not enough money, and with a travel distance of 11 to 25 miles and less than 10 miles to a body of water. They felt the quality of water at community recreational areas ranged from poor (7%), average (32%), good (50%), to very good (11%).

Water Professionals

Most water professional respondents were male (75%). They indicated overseeing primarily domestic, agricultural, and livestock water uses. The most common water uses listed were landscaping, drinking and personal, gardening and household, and the most used water sources indicated were water utilities, private wells, and surface water. Water professionals reported water utility water was primarily used for drinking and personal uses, followed by landscaping, household and gardening. Private wells were sources of water for ranching, livestock, irrigation, drinking and personal, and landscaping. Surface water provided for wildlife, ranching, livestock landscaping and irrigation. Water professionals felt most residents with wells had active wells (95%), some had inactive wells (79%), and some had both active and inactive wells (76%); well owners were thought to check their wells 1 to 3 times per year (69%), 4-6 times per year (9%), greater than 6 times per year (9%), and also that wells were to expensive to fix, so they didn't fix them (13%). When assistance was sought, private well maintenance companies were

believed to be called, along with the GCD and a neighbor with a well. In terms of well water quality responsibility, water professionals felt private landowners (80%), everyone above the aquifer recharge zone (54%), GCDs (54%), and landowners surrounding the well (48%) were responsible. Water delivery was another water source for drinking and personal, livestock, energy, and commercial uses, while rainwater provided for landscaping, wildlife, gardening, and ranching. Water professionals were primarily concerned with water availability (67%), ground water (57%), drought (55%), and water quality (41%). Specifically, water professionals were concerned with drought (69%), groundwater health (62%), and water conservation (53%), surface water health (46%), and domestic water availability (40%). Water assistance was sought from Groundwater Conservation Districts (61%), TCEQ (52%), river authorities (42%) and public water utilities (40%). Sewer (80%), septic (53%) and surface water (28%) were viewed as the most common wastewater management systems in communities, with (100%) of water professionals asserting that there were no wastewater challenges experienced in their communities over the last 5 years. Most water professionals were satisfied (43%) or very satisfied with their water providers dependability (22%), whereas (12%) were dissatisfied and (23%) were neutral on the subject. Water availability (56%), infrastructure damage outside of my property (48%), water quality (39%), and high cost of water (29%) were the primary challenges reported by water professionals. The majority (93%) felt that community members had access to reliable drinking water and had trust in their drinking water (89%). In terms of communication, most believed community residents had access to the internet and that residents preferred to receive water information via Groundwater Conservation Districts (58%), written media (51%), and local traditional media (49%). Water professionals provided information primarily in English and some in Spanish (31%). They were satisfied with the accessibility of the water information they provided to the community and with the methods they set in place for receiving information from the community, water providers, community leaders, and others. Water professionals were somewhat satisfied with the cost of water (very satisfied 18%, satisfied 28%, neither satisfied nor dissatisfied 42%, dissatisfied 9% and very dissatisfied 4%). Most believed 10% or less of a household's (77%) and business' (72%) income was spent on water. In prioritizing community water needs, water professionals indicated ensuring access to affordable drinking water (60%) and protecting private property rights of well owners (24%) were most important, with sustaining springs and rivers for recreation and wildlife as their next priority (9%). Recreational water quality perceptions varied (very poor 2%, poor 15%, average 35%, good 33%, and very good 16%). Finally, most water professionals indicated their communities had experienced flood damage (75%) and the majority had experienced drought damage (95%). Water professionals reported the frequency of water recreation participation as primarily less than once a month, with constraints involving lack of time, space, and money, and with a travel distance of primarily less than 10 miles to a body of water. They felt the quality of water at community recreational areas ranged from very poor (2%), poor (15%), average (35%), good (33%), to very good (16%).

Borderland Communities

Most water users (61% non-rural homeowners, 30% rural homeowners, 4% rural renters) had a water provider (86%) present in their community, with the exception of approximately 3% of border resident respondents. Water was used primarily for cleaning, cooking, bathing and

general hygiene, gardening domestic uses, drinking, pets and landscaping. Most (86%) used utility water for household, gardening, and drinking and personal uses (85% each), and some (50-55%) used utility water for energy development and commercial uses. This group was concerned about water quality (45%), availability (36%), affordability (32%), drought (22%), wastewater (14%), surface water (14%), and some had no water concerns (22%). Specific water concerns centered around water contamination in general (56%), water conservation (50%), cost of water (46%), water regulations (44%), water planning for local use (44%), drought (43%), water treatment for human consumption (42%), and water availability for residential areas (38%). For assistance with water, public water providers were the primary source of information, followed by county elected officials, other sources and private water utilities. In terms of ground and surface water rights ownership, most respondents indicated they did not own ground or surface water rights (74%), 22% stated they owned groundwater rights while 13% owned surface rights. Approximately 30% of border respondents lived in rural areas. In terms of wastewater management, half of respondents utilized a sewer system while a quarter used a septic system; graywater reuse (17%), surface water (8%), and ground water (4%) were also used for wastewater management. All respondents felt there were no wastewater challenges on their properties. In terms of water dependability, although respondents were satisfied with the dependability of their current water source, there did appear to be some level of dissatisfaction (very satisfied 40%, satisfied 28%, neither satisfied nor dissatisfied 12%, dissatisfied 12%, and very dissatisfied 8%). Water dependability challenges were associated with water quality (60%), high cost (52%), and water availability (36%). Many water users felt their community had access to reliable drinking water, although 30% indicated that not everyone in their community was as fortunate. In terms of communication, water users had access to the internet and a cell phone and preferred receiving information in both English (46%) and Spanish (54%) languages. Half of water users had access to a land line. Most were satisfied with the overall accessibility of water information that water providers offered (29% neither satisfied nor dissatisfied and 8% satisfied to dissatisfied). Respondents preferred to receive information via written media (40%), directly from water providers (36%), local traditional media (32%), internet advertisements (32%), and phone messages, community postings and meetings, each 28%. They were more satisfied (48%) than dissatisfied (8%)with the systems in place to relay information to water providers and other water-related representatives, and nearly half were neither satisfied nor dissatisfied (44%). Preferences for sharing information included community meetings (44%), and water provider, phone messages, and in-person meetings (each 32%). Respondents were somewhat satisfied with the cost of water (very satisfied 8%, satisfied 33%, neither satisfied nor dissatisfied with the cost 29%, dissatisfied 17%, very dissatisfied 13%), indicating they spent 10% or less (36%) and 11-20% (36%) of their household income on water (21-30% income, 12%; 31-40% income, 8%; 41-50% income, 4%; 71% income or more, 4%). Business owner respondents reported spending none (67%), 10% or less (10%) and 11-20% (14%) of their household income on water (21-30% income, 5%; 31-40% income, 5%). Ensuring access to affordable drinking water was the primary community need for the region's respondents (89%). Sustaining springs and rivers for

recreation and wildlife (18%) and protecting private property rights of well owners (14%) were stated priorities as well. Trust in drinking water quality was mixed (56% trusted their water quality and 44% did not). Recreation participation in the region centered around swimming in a local pool, camping, fishing, and relaxing by a river, lake or stream, with recreation in bodies of water occurring less than once a month. Participation constraints were associated with lack of time, places too far away, water not looking clean, places always full and not having someone with whom to recreate. Distance to the nearest body of water was less than 10 miles (14%), 11-25 miles (18%), 26-50 miles (9%), 51-100 miles (18%), greater than 100 miles (36%), with 5% of respondents indicating they did not have transportation to access a body of water. For those that did recreate, perceptions of water quality varied from very good to average (13% to 33%), and from very poor to poor (8% each, an additional 8% indicated they did not recreate in or near water). Finally, private wells were also a source of water for some respondents, with 8% owning active wells, 4% owning inactive wells, and another 4% owning both active and inactive wells on their property (84% indicated they did not have a groundwater well on their property). Of respondents with wells, 33% owned wells that had gone dry in the last 5 years. Wells were maintained 1 to 3 times per year (29%) and respondents also indicated that wells were too expensive to fix, so they did not check their wells (71%). When they needed help with their wells, private well maintenance companies were contacted (25%), along with friends or family members, water treatment companies, and groundwater conservation districts (each 13%). Respondents also indicated they had not needed any help with their wells (38%). Regarding responsibility for well water quality, respondents indicated they did not know who was responsible for well water quality (35%), some noted landowners/well owners were responsible for well water quality (20%), and others felt everyone above the recharge zone, elected officials and groundwater conservation districts were responsible for well water quality (15% each). Flood and drought damage was experienced by some respondents (flood, 67%; drought, 52%). Border respondents were 89% Latino and 75% female. Respondents (25%) had an annual income greater than $100,000, another 25% earned less than $25,000, 15% earned $25,000 to $40,000, and 33% earned between $40,001 to $85,000. Households with individuals below age 5 and over age 64 comprised half of respondents, and their ages ranged from 31 to 84 years.

Key Take-Aways

- Water concerns centered on availability, drought, quality, affordability, ground water and surface water. When it came to trust in drinking water quality, 78% of water users trusted their drinking water quality, while at least 89% of water providers, community leaders and water professionals trusted the quality of their drinking water.
- When considering water dependability, availability, quality, and high cost were respondent considerations, along with infrastructure damage outside of one's property. With respect to dependability and access, people felt they have dependable water sources and quality, yet there is a real concern that these may not be a reality in the future. Also, once safety has

been breached, it might take some community members a long time to trust their water source again, thereby, increasing their cost of water.

- Drought and overall water availability weighed heavily on survey respondents' minds, yet they also felt current water dependability and affordability were generally good or satisfactory, with some slight dissatisfaction. The contradiction suggests future water may be more of the driver for the concern. Most communities and respondents had personal experiences with either flood and/or drought.
- Dependency on groundwater continues to grow, with 54% of water user respondents not owning a private well, 45% depending on water utility water, and 34% indicating private well use (5% inactive well ownership, 8% both active and inactive wells on their properties). All place great pressure on the state's water sources and pose significant challenges moving forward, which were validated by expressed respondent concerns (10% of well owning respondents indicated their wells had gone dry in the past 5 years). Regarding well water quality responsibility, well management, and the role of managers, there was a heavy emphasis on well owners, everyone above the aquifer recharge zone and groundwater conservation districts as having responsibility for wells.
- Respondents felt opportunities to recreate existed across the state, although policymakers, water providers, and water professionals felt water users had more time to recreate than was their reality.
- Action: Improving recreation access may be beneficial, by making it easier for people to recreate, but not without simultaneously addressing other barriers, such as time to recreate, accessible groups with whom to recreate, and decreasing distance to recreational areas or providing transportation options.
- There was a preference for staying within one's comfort zone with respect to communications. For example, water users preferred sharing information in-person (42%), via community meetings (31%), written media (29%), directly with the water provider (25%), water meetings (24%), local traditional media (22%) and phone messages (21%). They also preferred to receive water information via written media(41%), water providers (39%), local traditional communications (30%), groundwater conservation districts (29%), community meetings (26%), internet advertisings (24%) and community postings (23%), water meetings (22%), and phone messages (15%). There were slight differences in information sharing and receiving among community leaders, water providers and water professionals.
- Action: To meet community needs, align incoming and outgoing communication strategies for accessibility, to reach water users more effectively, may be a consideration, especially when safety may be a consideration. There appears to be communication among water professionals, water providers, and water leaders; however, increasing and/or maintaining communication with water users would be helpful.
- Borderland communities appear to have the greatest distrust for drinking water quality of all groups surveyed.

- Action: Determine if water quality perceptions in the region are associated with structural and accessibility factors (testing, infrastructure, citizen participation, community wide efforts, including water providers, water professionals, and community service organizations as avenues for ameliorating water quality challenges).
- Action: Accessibility to well maintenance programs and/or information may be a consideration given responses for maintenance limitations associated with maintenance costs.

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